

# **EXHIBIT Q**

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**UNITED STATES DISTRICT COURT  
FOR THE SOUTHERN DISTRICT OF NEW YORK**

NIKE, INC.,

Case No. 1:22-cv-000983-VEC

Plaintiff,

v.

STOCKX LLC,

Defendant.

**EXPERT REPORT OF CATHERINE TUCKER**

**MAY 5, 2023**

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## I. INTRODUCTION

1. I am the Sloan Distinguished Professor of Management Science at MIT Sloan at the Massachusetts Institute of Technology (“MIT”) in Cambridge, Massachusetts. I received an undergraduate degree in Politics, Philosophy and Economics from Oxford University in the United Kingdom. I received a PhD in Economics from Stanford University in 2005. I have been a professor at MIT since completing my Ph.D.

2. My academic specialty lies in studying the evolution of business models in the digital era. One area in which I have specialized has been the study and determinants of success of platform business models in digital settings. Given this expertise, I was recently asked to present in the introductory plenary session to the FTC hearings on the current economic understanding of multi-sided platforms.<sup>1</sup> I teach our Platform Strategy executive education course at MIT Sloan.<sup>2</sup>

3. I am Senior Editor at *Marketing Science*. I have been an Associate Editor at *Management Science*, *Marketing Science* and the *Journal of Marketing Research*, and Co-Editor of the *Journal of Quantitative Marketing and Economics*. I was a Co-Editor of the recent National Bureau of Economics Research volume on the Economics of Digitization. I received a National Science Foundation CAREER Award, which is the National Science Foundation’s most prestigious award in support of junior faculty who “exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations.”<sup>3</sup> I have testified twice before Congress on policy issues relating to new digital technologies and have presented my research to the Federal Trade Commission, the IMF, the Federal Communications Commission, and the OECD. I have published multiple academic papers in leading scientific, economics, marketing,

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<sup>1</sup> Federal Trade Commission, *FTC Hearing 3: Oct. 15, Network Effects in Multi-Sided Platforms*, October 15, 2018, [www.ftc.gov/news-events/audio-video/video/ftc-hearing-3-oct-15-welcome-remarks-session-1-economics-multi-sided](http://www.ftc.gov/news-events/audio-video/video/ftc-hearing-3-oct-15-welcome-remarks-session-1-economics-multi-sided).

<sup>2</sup> MIT Sloan Executive Education, “Platform Strategy: Building and Thriving in a Vibrant Ecosystem,” <https://executive.mit.edu/on-demandware.static/-/Sites-master-catalog-msee/default/dwc6b9d6db/brochures/Platform%20Strategy.pdf>.

<sup>3</sup> National Science Foundation, “Faculty Early Career Development Program (CAREER),” [https://web.archive.org/web/20161001075217/https://www.nsf.gov/funding/pgm\\_summ.jsp?pgms\\_id=503214](https://web.archive.org/web/20161001075217/https://www.nsf.gov/funding/pgm_summ.jsp?pgms_id=503214).

management, and information systems journals, including *Science*, *Journal of Political Economy*, *RAND Journal of Economics*, *Management Science* and *Information Systems Research*.

4. I am being compensated for my services in this matter at my customary hourly rate of \$1,400. In preparing this report, I have been assisted by certain employees of Analysis Group. My curriculum vitae and list of prior testimony are attached as Appendices A and B.

## II. ALLEGATIONS, ASSIGNMENT, AND CONCLUSIONS

### A. Allegations

5. Nike alleges that StockX engages in “selling counterfeit Nike goods, and making false and/or misleading claims regarding the purported authenticity of those goods.”<sup>4</sup> According to Nike, StockX “knows that its false and/or misleading statements about the authenticity of the Nike goods for sale on its platform deceives consumers. Nevertheless, StockX continues to engage in such improper and unlawful business practices to attract consumers to its platform.”<sup>5</sup> Nike alleges that these actions constitute “false advertising and false representations.”<sup>6</sup>

6. Nike also alleges that, “without Nike’s authorization or approval, StockX is ‘minting’ NFTs that prominently use Nike’s trademarks, marketing those NFTs using Nike’s goodwill, and selling those NFTs at heavily inflated prices to unsuspecting consumers who believe or are likely to believe that those ‘investible digital assets’ (as StockX calls them) are, in fact, authorized by Nike when they are not.”<sup>7</sup>

7. Further, Nike claims that “Nike-branded Vault NFTs … are, in fact, new virtual products that StockX has bundled with additional StockX services (e.g., ‘Vault Services’) and unspecified benefits (e.g., ‘exclusive access to StockX releases, promotions, events’).”<sup>8</sup> Nike claims that “StockX has sold Nike-branded NFTs at prices many multiples above the price of the

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<sup>4</sup> First Amended Complaint, *Nike, Inc. v. StockX LLC*, No. 1:22-cv-000983-VEC, May 25, 2022 (“First Amended Complaint”), ¶ 15.

<sup>5</sup> First Amended Complaint, ¶ 113.

<sup>6</sup> First Amended Complaint, ¶ 175.

<sup>7</sup> First Amended Complaint, ¶ 5.

<sup>8</sup> First Amended Complaint, ¶ 6

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physical Nike shoe” and that “certain Nike-branded Vault NFTs [were] still selling for thousands of dollars above the price of the physical shoe” as of May 2022.<sup>9</sup>

### **B. Assignment**

8. I have been asked by counsel to:
  - a. Explain the features and characteristics of StockX’s marketplace and business model;
  - b. Explain how trust contributes to the success of resale marketplaces, and the potential implications for such platforms if they tolerate fraud on their platform;
  - c. Assess how the Vault NFTs create value for their purchasers or holders by making it easier and cheaper to transact on StockX; and
  - d. Assess the price patterns of Vault NFTs linked to physical Nike shoes, including interpretations that explain the observed pricing patterns.

### **C. Summary of conclusions**

9. Based on my expertise in economics and my analysis of relevant documents in this case I have reached the following opinions:

- a. StockX—like other online resale marketplaces—creates value by using digital technologies to make it easier for buyers and sellers to trade. Those technologies and features include, among others, a single streamlined page for a given product, a bid or buy pricing mechanism, and a payment processing system, which together reduce search, information, and transaction costs faced by buyers and sellers. Together, these technologies and features have allowed StockX to overcome various drawbacks of the offline resale of high-end products and collectibles, such as the distances in time and space that make matching buyers and sellers a challenge. See Section IV.

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<sup>9</sup> First Amended Complaint, ¶¶ 63, 65.

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- b. The success of resale marketplaces hinges on their ability to enable positive interactions between buyers and sellers and establish trust between both groups. StockX—like other similar platforms—has an incentive to generate and preserve trust on its platform and would risk the success of its business if it did not take steps to prevent the sale of counterfeit items, which could lead to an erosion of buyers’ trust. See Section V.
  - i. StockX relies on various features and technologies to increase trust and accountability on the platform. One of its most salient trust-building features is its verification process and the accompanying “StockX Verified” label for all products sold on the platform. Using a verification process has benefits relative to other trust-building practices, like ratings and review systems. Ratings and review systems are often relied upon by online marketplaces, but their informativeness varies, especially in situations where buyers cannot judge the quality of their purchase at the time they write the review.
  - ii. StockX provides detailed data about historical prices and live bids and asks for items on the platform. Such transparency helps ensure that neither buyers nor sellers trade at an unfair price on the platform, and it further discourages the sale of counterfeits by drawing attention to prices that are too low to be credible.
- c. Multiple features and technologies have been developed throughout recent history to facilitate the trade of physical goods, including (1) untethering ownership from physical possession, (2) innovations that reduce information costs through reduced verification costs, and (3) storage solution vaults that improve the tradability of physical goods. StockX’s Vault NFTs are an innovation that incorporates these three features. As a result, StockX’s Vault NFTs reduce transaction costs associated with the trade of physical goods, which can be beneficial to consumers interested in trading sneakers and other collectibles. See Section VI.

- d. StockX initially priced the Vault NFTs at a discount compared to the price of the physical pairs on the platform. On the first day of trading, the prices of the first Vault NFTs linked to Nike sneakers spiked. But in a matter of weeks, transaction volume and prices dropped, and prices converged to a level close to the price of physical shoes, as expected by StockX’s leadership. See Section VII.A.
- e. High initial prices followed by a price decline for traded assets are not an unusual phenomenon, particularly for new technologies that investors find difficult to value in their early days. The price dynamics observed for StockX’s Vault NFTs are therefore not unlike the ones seen for a range of assets linked to other new technologies, including other blockchain-based decentralized finance innovations. In the case of Vault NFTs, the uncertainty regarding the valuation of the new asset, the underlying technology, and the adoption rate of the new product may have caused initial high demand followed by a rapid correction, possibly once uncertainty and initial over-excitement faded. See Section VII.B.

10. In forming my opinions for this report, I have relied on my experience and the sources listed in Appendix C. If additional relevant information is made available to me, I may adjust or supplement my opinions.

### **III. BACKGROUND**

#### **A. Parties**

##### *1. StockX*

11. StockX is an online resale marketplace that connects buyers and resellers of “the hottest sneakers, apparel, electronics, collectibles, trading cards and accessories.”<sup>10</sup> StockX grew out of a company created in 2012 that tracked sneaker resale data, including average price, volume, and volatility, on eBay.<sup>11</sup> Co-founders Dan Gilbert, Josh Luber, and Greg Schwartz

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<sup>10</sup> StockX, “The Current Culture Marketplace,” <https://stockx.com/about/how-it-works/> (“Our mission is to provide access to the world’s most coveted items in the smartest way possible. Buy and sell the hottest sneakers, apparel, electronics, collectibles, trading cards and accessories.”).

<sup>11</sup> StockX, “Campless,” August 30, 2013, <https://stockx.com/news/campless>.

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developed StockX to provide an online marketplace for high-end sneakers.<sup>12</sup> Over time, the StockX marketplace has expanded to facilitate the trade of other luxury items, including apparel, trading cards, accessories such as handbags and watches, and other various collectibles. In addition, in January 2022, StockX began offering Vault NFTs: digital tokens tied to physical products such as sneakers, trading cards, watches, and skateboard decks stored in StockX’s climate-controlled, high-security vault.<sup>13</sup>

## 2. Nike

12. Nike is the world’s largest producer of athletic shoes and sports apparel.<sup>14</sup> A key event in the history of Nike and the collectible nature of its sneakers was its partnership with Michael Jordan in 1984, followed by the release of the Nike Air Jordan 1.<sup>15</sup> Nike has since continued to develop more mainstream offerings, such as running clothing, alongside high-profile collaborations with celebrities like designer Virgil Abloh and rapper/musician Travis

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<sup>12</sup> Crain’s Detroit Business, “Greg Schwartz, 38,” August 30, 2019, <https://www.crainsdetroit.com/awards/greg-schwartz-40-under-40-2019> (“That ‘something’ was an online marketplace for high-end collectibles, starting with luxury sneakers. The company has since branched out into luxury handbags, watches and streetwear.”); Erin Griffith, “Buy Low-Tops, Sell High-Tops: StockX Sneaker Exchange is Worth \$1 Billion,” *The New York Times*, June 26, 2019, <https://www.nytimes.com/2019/06/26/technology/trading-sneakers-stockx.html> (“StockX grew out of Campless, a website that Josh Luber, a former I.B.M. consultant, built in 2012 to track sneaker resale prices on eBay. After Mr. Luber delivered a popular TED Talk titled ‘Why sneakers are a great investment,’ Dan Gilbert, owner of the Cleveland Cavaliers, and a co-founder, Greg Schwartz, acquired Campless. Campless eventually transformed itself into StockX, a marketplace to buy and sell sneakers.”).

<sup>13</sup> StockX, “NFTs,” <https://stockx.com/lp/nfts> (“Introducing Vault NFTs on StockX, new digital tokens providing unprecedented access and utility for our customers. Each Vault NFT is tied to a physical product (as depicted on the NFT), which is stored in our brand new, climate-controlled, high-security vault.”).

<sup>14</sup> Bloomberg, “Phil Knight & family,” <https://www.bloomberg.com/billionaires/profiles/philip-h-knight> (“Knight is the founder and largest shareholder of Nike, the world’s biggest maker of athletic shoes and sports apparel. The Beaverton, Oregon-based company operates more than 1,100 stores and had revenue of \$44.5 billion in the year to May 2021.”).

<sup>15</sup> Sotheby’s, “The Meteoric Rise of the Nike Air Jordan Brand,” January 25, 2023, <https://www.sothbys.com/en/articles/the-meteoric-rise-of-the-jordan-brand> (“In 1984, Nike signed up-and-coming basketball rookie Michael Jordan to an unprecedented \$500,000 a year endorsement deal ... But it was the release of the first Jordan shoe in 1985 that truly propelled the Jordan brand to new heights. The first Jordan shoe, the Nike Air Jordan 1, was an instant hit, kicking off modern sneaker collecting as we know it.”); Expert Report of DeJongh “Dee” Wells, *Nike Inc. v. StockX LLC*, 1:22-cv-000983-VEC, May 5, 2023 (“Wells Report”), ¶ 45 (“The ‘second phase’ of Sneakerhead culture started with Michael Jordan wearing the Nike Air Ship in 1984, which served as the inspiration for the Air Jordan 1, which was released to the market in 1985. Michael Jordan’s endorsement of what became his signature sneakers proved to be a watershed moment in the development of the Sneakerhead culture that found ‘its way more and more into the general public,’ by transcending cultural boundaries that existed during the 1970s. The release of the Air Jordan was deemed a ‘turning point’ in the Sneakerhead culture, and sneakers’ appeal became broader.”).

Scott.<sup>16</sup> Nike releases certain shoes in limited editions, which often sell out. In those cases, limited edition sneakers will typically be traded on the secondary market, often at prices much higher than the retail price.<sup>17</sup>

## IV. HOW RESALE MARKETPLACES INCLUDING STOCKX CREATE VALUE

### A. The economics of resale marketplaces

13. Marketplaces are a type of multi-sided platform, and specifically a two-sided platform, which is an economics term that refers to businesses that facilitate interactions between multiple groups of users. This type of business model is not new. Early examples include medieval fairs, which brought together buyers and sellers of agricultural products.<sup>18</sup> However,

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<sup>16</sup> Vogue, “From Sacai to Jacquemus: 14 Nike Sneaker Collabs to Know and Shop,” <https://www.vogue.com/article/14-nike-sneaker-collabs-to-know-and-shop> (“Virgil Abloh of Off-White and Nike joined forces in 2019 to create a Waffle Racer built for speed and optimized for style.”); High Snobiey, “The Complete Beginner’s Guide to Every Travis Scott Sneaker Collaboration,” 2019, <https://www.hightsnobiety.com/p/travis-scott-jordan-nike-collab> (“All the while, Scott’s collaboration with Nike and Jordan Brand has been picking up steam.”); Wells Report, ¶ 6 (“Alongside its mainstream products, such as running shoes and clothing, Nike has joined other brands in releasing limited edition sneakers, including through collaborations with celebrities like fashion designer Virgil Abloh and rapper Travis Scott.”), ¶ 54 (“There are additional ways brands can build hype for a product launch outside of social media. For instance, in 2022, Nike launched a raffle for the chance to buy the new ‘Reverse Mocha’ Jordan 1 Low designed by Travis Scott. The raffle drew 2.4 million entries in its first 30 minutes, ultimately reaching 3.8 million entries, a record for Nike’s SNKRS app. Notably, this was just an entry for the chance to buy a ‘Reverse Mocha’; winners still had to purchase the actual sneaker.”), ¶ 62 (“After Virgil Abloh’s passing in 2021, the price of Off-White sneakers, designed by Abloh in collaboration with Nike, spiked on resale platforms and stores. While prices settled in the days following his death, they generally remained higher than they were when Abloh was alive.”).

<sup>17</sup> Wells Report, ¶ 75 (“Brands, including Nike, use scarcity as a marketing device, capitalizing on Sneakerheads’ desire to own rare sneakers. Footwear brand ASICS’s Lifestyle Director Mike Jensen noted ‘scarcity is currency.’ Nike calls this strategy ‘quick strikes,’ reporting over 40 collab/limited edition sneakers on its website, and featuring a calendar of upcoming releases, with new limited editions dropping daily. More recently, Nike has begun selling limited-release shoes exclusively through a lottery system only accessible in its SNKRS app.”), ¶ 76 (“The resale market for sneakers has exploded in recent years and is expected to continue its rapid growth, estimated to reach \$30 billion globally by 2030. The resale market has played a vital role in making sneakers more accessible. It is, and has always been, an important means through which Sneakerheads can access the rare and limited release styles that they may not have been able to obtain directly from the brand. When limited releases sell out when released by the brand, they then are available only through the resale market, often at prices much higher than the original retail price.”).

<sup>18</sup> Steven Tadelis, “Reputation and Feedback Systems in Online Platform Markets,” *NBER Working Paper*, 2016, pp. 1-33, p. 2 (“Coordinating where and when trade took place was an important historical innovation, which can be seen in the introduction of trade fairs in medieval Europe.”); Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, p. 10 (“According to historians, European trade took off at the end of the twelfth century in what is now the North of France, in the county of Champagne. It is in this period that this county started to host regular trade fairs, which lasted for six weeks and

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thanks to digital technologies, the number of two-sided digital platforms—including resale marketplaces—has grown in the last 15 to 20 years. For example, eBay and Etsy help buyers and sellers find each other to exchange goods, while OpenTable makes it easier for diners to make reservations at restaurants with availability, Airbnb makes it easier for hosts with spare rooms and guests to find each other, and Bumble makes it easier for singles looking for dates to match.

14. Marketplaces connect buyers and sellers of items, new or used, and make it easier for them to meet and exchange products and services. Marketplaces are characterized by the three fundamental features of two-sided platforms:

- a. A marketplace brings together two customer groups: buyers and sellers. In some cases, buyers and sellers are two distinct groups, as is the case, for instance, for farmers and city-dwellers in the context of a farmer’s market. In other cases, platform users may use the platform both to buy and to sell, as is the case, for instance, in a stock market. A marketplace provides its services to both groups and therefore views both groups as customers.
- b. Marketplaces create value by facilitating and encouraging exchanges between buyers and sellers. Buyers and sellers would like to interact but may face various types of search, information, and transaction costs that make interactions costly or inconvenient.<sup>19</sup> Search costs are incurred by buyers and sellers to find each other; for example, they could consist of the time spent trying to find short-term accommodations available in a given city on certain dates.<sup>20</sup> Information costs refer to costs that buyers incur while trying to gather information and learn about

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rotated among six cities. Merchants came from all over Europe because they were confident that they would meet each other at these fairs.”).

<sup>19</sup> David Evans and Michael Noel, “Defining Markets that Involve Multi-sided Platform Businesses: An Empirical Framework with an Application to Google’s Purchase of DoubleClick,” *Working Paper*, No. 07–18, 2007, pp. 1–47, p. 3 (“[Multi-sided platforms] provide goods or services to several distinct groups of customers who need each other in some way and who rely on the platform to intermediate transactions between them. They typically reduce transaction costs and thereby permit value-creating exchanges to take place that otherwise would not occur. In particular they facilitate the realization of indirect network externalities, and externalities in use, between the members of distinct customer groups.”); Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, p. 39 (“[Exchanges] help ‘buyers’ and ‘sellers’ search for feasible contracts and for the best prices.”).

<sup>20</sup> Andrei Hagiu, “Multi-sided Platforms: From Microfoundations to Design and Expansion Strategies,” *Working Paper*, No. 09-115, 2008, pp. 1-25, p. 5 (“Search costs are costs incurred by the multiple sides before they actually interact, in order to determine the best ‘trading partners’.”).

sellers and their products, and that sellers incur in trying to learn about possible buyers, after they have found each other; for instance, learning details about the quality of the available short-term accommodation.<sup>21</sup> Transaction costs are incurred by one or both sides in the process of transacting, that is, once a buyer and seller have matched; for instance, finding a convenient way to pay for the accommodation.<sup>22</sup> A marketplace creates value by lowering costs generated by frictions such as search, information, and transaction costs.

- c. Successful marketplaces enable what economists call positive indirect network effects, that is, the greater benefits that customers on one side of the platform enjoy as a result of interacting with more customers on the other side of the platform.<sup>23</sup> On a marketplace, buyers benefit from the presence of more sellers on the platform and vice-versa. This is because a seller benefits if there are more buyers to whom they can sell, and a buyer benefits if there are more sellers from whom they can buy. A two-sided platform is able to succeed to the extent that it can coordinate the presence of users on both sides of the platform.<sup>24</sup>

15. In some cases, the marketplaces mostly involve sellers that sell their own goods or services; for example, farmers through farmers markets, developers through Apple’s App Store,

<sup>21</sup> David Evans, “The Antitrust Economics of Multi-Sided Platform Markets,” *Yale Journal on Regulation*, Vol. 20, 2003, pp. 325-381, pp. 332-333 (“Generally, in matchmaking markets customers of each type benefit from being able to search a larger group of customers of the other type for a suitable match. They also benefit from being able to search among a group that has been narrowed to suitable matches … Information and transaction costs as well as free-riding make it difficult in practice for members of distinct customer groups to internalize the externalities on their own.”).

<sup>22</sup> Andrei Hagiu, “Multi-sided Platforms: From Microfoundations to Design and Expansion Strategies,” *Working Paper*, No. 09-115, 2008, pp. 1-25, p. 6 (“The second fundamental function is to reduce the costs incurred during the transactions themselves, i.e. *after* search is over and the transacting parties have found each other. A portion of these costs is generally common to all transactions between different members of the relevant sides of the MSP, which is why we call them ‘shared’ or ‘duplicate’ costs.”).

<sup>23</sup> David Evans and Richard Schmalensee, *Matchmakers: The New Economics of Multisided Platforms*, Boston, Harvard Business Review Press, 2016, p. 25 (“A network effect is *indirect* when the value of a matchmaker to one group of customers depends on how many members of a *different* group participate.”). Echoing Dr. Evans, I abbreviate positive indirect network effects as indirect network effects in this report.

<sup>24</sup> David Evans and Richard Schmalensee, *Matchmakers: The New Economics of Multisided Platforms*, Boston, Harvard Business Review Press, 2016, p. 25 (“A network effect is indirect when the value of a matchmaker to one group of customers depends on how many members of a different group participate.”); Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, p. 17 (“On a trading platform, buyers are, everything else being equal, typically better off the more sellers are present and vice versa: Both groups exert a positive cross-group network effect on the other group.”).

and hosts through Airbnb. In other cases, the marketplaces focus on facilitating the resale of goods, such as art auction houses like Christie’s and Sotheby’s, Poshmark, Depop, or eBay.

Those marketplaces are called resale, or secondary, marketplaces. A marketplace may cater to both types of sellers.

16. Online marketplaces have grown as digital technology and procedures have made it easier to facilitate transactions between sellers and buyers online.<sup>25</sup> Examples of online resale marketplaces for fashion and collectible items, in addition to StockX, include the online fashion consignment platforms Depop, Vestiaire Collective, and thredUP; sneakers and apparel platform GOAT; and the watch-selling platform Chrono24.

17. The value offered by online marketplaces as compared to offline alternatives they replaced is evident in many contexts. Before the introduction of Airbnb and similar platforms, it was difficult for guests to find short-term residential lodging at a particular destination without pre-existing relationships or a knowledge of a local, short-term rental company. Consumers without that knowledge or those relationships were limited to hotels which may have been too expensive or fully booked. Symmetrically, it was difficult for property owners to offer a room, apartment, or house for short-term stays. Transactions simply did not occur, and both guests and property owners with idle homes were less well-off. Similarly, originally launched as an online auction site, eBay helped people looking to trade collectibles find one another and agree on a price through an electronic bidding process. Absent the website, collectors would have to incur significant costs to transact; for instance, traveling to conventions to find fellow buyers and sellers and transporting goods to and from such conventions. More recently, the online shopping platform Poshmark emerged as an alternative to physical consignment stores, which are generally space-constrained and can only serve buyers and sellers within a single geographic area. By removing geographic barriers to trade, online marketplaces like eBay and Poshmark help products reach consumers who value them most, making the platform valuable to buyers and, in turn, more valuable to sellers.<sup>26</sup>

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<sup>25</sup> Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, p. 11 (“The reason why platforms are so prevalent nowadays is that the Internet and digital technologies have dramatically reduced a number of transaction costs, thereby facilitating a wide array of interactions.”).

<sup>26</sup> Akshita Sharma et al., “Relationship between customer satisfaction and loyalty,” *Social Science Research Network*, 2020, p. 9 (“Once the customer is satisfied they would return for repeat future purchases and

## B. How StockX works and creates value

18. StockX is an online marketplace that makes it easier for buyers seeking to purchase items such as sneakers, apparel, luxury handbags, and electronics, and sellers offering these items to find each other and transact. Since its inception, StockX has been popular among sneaker collectors who use the platform to acquire high-end sneakers that are otherwise difficult to find or acquire.<sup>27</sup>

19. StockX’s business model is based on digital technologies and features to reduce search, information, and transaction costs faced by both buyers and sellers. It was conceived by its founders as “the stock market of things,”<sup>28</sup> with a goal of bringing standardization and price transparency to trading in the sneaker resale market.<sup>29</sup> For example, as highlighted in its marketing material, StockX consolidates all information and trading options for a given product on a single product page, therefore reducing search costs for buyers relative to resale platforms with seller-specific listings for the same product.<sup>30</sup> The standardization also benefits sellers, who

eventually become loyal, and a loyal customer will always spread positive word of mouth which leads to increase in both sales and profitability as loyal customer will bring new customers to the firm.”); Andreas Lendle, Marcelo Olarreaga, Simon Schropp, and Pierre-Louis Vézina, “There Goes Gravity: eBay and the Death of Distance,” *The Economic Journal*, Vol. 126, No. 591, 2016, pp. 406-441, pp. 432-433 (“[W]e estimate a distance effect on trade flows that is about 65% smaller on eBay [relative to total trade data collected from national customs offices] ... this difference in distance effects is most-likely due to online technologies that reduce information frictions associated with geographic distance.”).

<sup>27</sup> Quartz, “StockX, a Sneaker Resale Site, Is Now Worth \$3.8 Billion,” April 9, 2021, <https://qz.com/1994596/stockx-a-sneaker-resale-site-is-now-worth-3-8-billion> (“Today sneaker resale has exploded, in part due to the rise of shops and sites that have turned reselling limited-release sneakers into a large and lucrative business. The online leader in this category is StockX.”); Business Insider, “These Are The Most Popular Sneakers on Resale Sites - And How Much You Can Make For Each One,” August 13, 2021, <https://www.businessinsider.com/stockx-most-popular-sneakers-resale-sites-price-value-data-2021-8> (“Sneakerheads looking to score rare and exclusive heat turn to platforms like StockX which serves as a guiding light for original pricing, resale value, and price volatility.”).

<sup>28</sup> Jacob Gallagher, “This Website is the Stock Market for Nikes and Rolexes,” *The Wall Street Journal*, November 26, 2018, <https://www.wsj.com/articles/this-website-is-the-stock-market-for-nikes-and-rolexes-1543251772>.

<sup>29</sup> Jacob Gallagher, “This Website is the Stock Market for Nikes and Rolexes,” *The Wall Street Journal*, November 26, 2018, <https://www.wsj.com/articles/this-website-is-the-stock-market-for-nikes-and-rolexes-1543251772> (“What really bugged [Luber] was the absence of price standardization ... Mr. Luber envisioned a more orderly market, with a New York Stock Exchange-style ticker, that would make the value of a pair of sneakers transparent, in real time.”).

<sup>30</sup> StockX, “Buying,” <https://stockx.com/about/buying> ([audio] at 0:00 – 0:28 “Meet Andre. He really wants to cop a pair of one of his all-time favorite [sneakers] ... Andre goes to StockX.com where he finds the one page for the [sneakers] he’s looking for. Not browsing through thousands of listings like you know who. Because

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do not need to spend time taking photos of the product and creating a customized listing.<sup>31</sup> StockX also uses a bid or buy pricing mechanism in which sellers post asking prices and buyers may submit bids or buy from the lowest asking price.<sup>32</sup> Each product page also provides historical price information for the product, which helps buyers not overpay and sellers not undersell.<sup>33</sup> These features, combined with StockX’s payment processing system allow buyers and sellers to find one another, agree on a price, and complete transactions in a seamless fashion.

20. StockX also relies on various features and technologies to increase trust and accountability between buyers and sellers on the platform. As described in Section V, these features and technologies include the platform’s verification process and inclusion of detailed pricing data on product pages. Together, these efforts have allowed StockX to overcome various drawbacks of the offline resale of high-end products and collectibles, such as the distances in time and space that make matching buyers and sellers more difficult.

21. Resale platforms such as StockX have been especially valuable for individuals who collect and trade collectibles—such as sneakers—by increasing overall interest and participation in the resale markets, including the rare sneaker market.<sup>34</sup>

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everything happens on this one page, Andre can quickly see the prices on every pair that’s ever been sold in every size in one convenient place.”).

<sup>31</sup> StockX, “Selling,” <https://stockx.com/about/selling> (“Just search for your product and set your price. You won’t need to take product pictures, share personal information, or negotiate with potential Buyers.”).

<sup>32</sup> StockX, “Buying,” <https://stockx.com/about/buying> (“Buy Now at the lowest Ask, or place a lower Bid at the price you want to pay. We will send you immediate updates as prices move on your Bids. Bids can be renewed or let go when they’re about to expire, and you’ll be notified ahead of time.”).

<sup>33</sup> Sneaker Jagers, “How StockX Became the Biggest Sneaker Marketplace,” September 30, 2021, <https://www.sneakerjagers.com/en/n/how-stockx-became-the-biggest-sneaker-marketplace/27074> (“When buying a sneaker, you can get insight into the rises and falls of the prices. In this way, the company remains transparent about the prices and you get insight into the market value of your pair.”).

<sup>34</sup> Complex, “The Rise of the Reseller,” November 20, 2019, <https://www.complex.com/sneakers/2019/11/rise-of-the-sneaker-reseller-in-the-2010s> (“No one understands the Wall Street-like nature of the sneaker aftermarket better than Josh Luber … He estimates that about 20,000 transactions take place on StockX each day, with the bulk of those being sneakers. Power sellers using the platform earn upwards of six figures a year; a handful even hit the million-dollar mark.”); Jacob Gallagher, “This Website is the Stock Market for Nikes and Rolexes,” *The Wall Street Journal*, November 26, 2018, <https://www.wsj.com/articles/this-website-is-the-stock-market-for-nikes-and-rolexes-1543251772>.

## V. RESALE MARKETPLACES AND THE NEED TO CREATE AND MAINTAIN TRUST

22. The success of resale marketplaces hinges on their ability to enable positive interactions between buyers and sellers and establish trust between both groups. Resale marketplaces that fail to cultivate positive interactions do so at the risk of their reputation and viability as a business. StockX, like other similar platforms, has an incentive to ensure trust on its platform, and would risk the success of its business if it did not take steps to prevent the sale of counterfeit items.

### A. A primer on coring

23. Because marketplaces are in the business of facilitating transactions, a key to their success is that the interactions that occur through them are positive for both buyers and sellers. Interactions that are negative for either side deter users from joining or continuing to use the platform.<sup>35</sup> Marketplaces are therefore incentivized to facilitate and manage the interactions between buyers and sellers—for instance, by reducing search, information, and transaction costs and encouraging good behavior on the platform—to ensure that buyers and sellers continue to use the platform. Platform economists use the term “coring” to refer to the ability of two-sided platforms, in general, and marketplaces, in particular, to actively manage and maintain buyer and seller interactions to ensure their quality.<sup>36</sup>

24. To facilitate positive interactions and support coring, platforms rely on technology, processes, and policies aimed at improving quality and promoting trust in the performance and security of the platform.<sup>37</sup> Preventing or minimizing negative interactions in the

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<sup>35</sup> Avi Goldfarb and Catherine Tucker, “Digital Economics,” *Journal of Economic Literature*, Vol. 57, No. 1, 2019, pp. 3-43, p. 26 (“The failure of the reputation systems hurts the platform, rather than the individual seller.”).

<sup>36</sup> Catherine Tucker, “How Platforms Create Value Through Coring and Implications for Market Definition,” *CPI Antitrust Chronicle*, Vol. 2, No. 2, 2022, pp. 16-19, p. 17 (“Platforms enable multiple distinct groups of users to interact with one another, and platform economists refer to the practice of actively managing these interactions to ensure they go well as ‘coring.’”).

<sup>37</sup> Catherine Tucker, “How Platforms Create Value Through Coring and Implications for Market Definition,” *CPI Antitrust Chronicle*, Vol. 2, No. 2, 2022, pp. 16-19, p. 17 (“A platform acts as a ‘core’ for these interactions by adopting technology, policies, and procedures that facilitate the interaction taking place, build trust in the interactions, and provide incentives for interactions to stay on the platform. This often requires transaction

short run increases user trust in the quality of interactions, and therefore helps platforms maximize the number of interactions in the long run, a necessary condition to their success. Examples of coring activities commonly used by platforms to improve and build user trust include screening protocols, such as background checks and identity verifications for users, and rating systems, which help users find high-quality matches while simultaneously incentivizing good behaviors. Platforms also may have mechanisms for users to report poor experiences on the platform or procedures to remove or restrict users who undermine the quality of interactions on the platform. Finally, some platforms offer dispute resolution services and protections for users, such as insurance.<sup>38</sup>

## B. Trust in online and resale marketplaces

### 1. *Marketplaces that fail to establish or that lose trust risk their reputation and the viability of their platform*

25. In an online marketplace, buyers and sellers that match on the platform typically do not know one another, may be entirely anonymous, and often have no means of inspecting the product they want to buy before the purchase. Both sides possess private information, such as the seller’s knowledge of the quality of the good or service sold and the buyer’s perception of that quality and their willingness to pay.<sup>39</sup> This informational asymmetry can make transactions risky. Buyers may be uncertain that they will receive their purchase and that it will be of the expected quality, while sellers may worry that they will not receive their payments on time or that they will have to deal with dishonest and difficult buyers. For instance, on platforms like eBay that do not make any effort to verify what the seller is sending to the buyer, buyers can be scammed by

platforms to establish governance mechanisms based on observable transactions that ensure successful interactions.”).

<sup>38</sup> See, for example, Airbnb, “Host Liability Insurance,” <https://www.airbnb.com/help/article/937>.

<sup>39</sup> Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, pp. 124-125, p. 125 (“[A]symmetric information problems are common on platforms. It is indeed rare that users know one another before interacting on a platform. As a result, users may ignore many important aspects of their potential counterparts that are relevant for their valuation of the platform: What is their willingness to participate to the interaction? How will they behave during the interaction? Will they respect the terms of the transactions? And so on. These problems are particularly prominent on platforms that facilitate the trade of goods, as buyers typically have less information than sellers about the quality of the goods or services offered for sale (either because this information is hidden or because it is costly to search.”).

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fraudsters selling empty boxes of PlayStation consoles.<sup>40</sup> Like other resale marketplaces, buyers on online resale marketplaces also face the risk of buying counterfeit or defective items, since they are not buying directly from the manufacturer or an authorized retailer.

26. If buyers and sellers stop trusting the platform, economic theory predicts that the marketplace can quickly unravel. Buyers, factoring in the uncertainty about the authenticity and quality of the purchase, will opt to pay less, while sellers of genuine items will leave the platform because they could not achieve a satisfactory price on the platform.<sup>41</sup> Sellers may also leave after being scammed by buyers. This idea is expressed in *The Economics of Platforms* as follows:

[T]ransactions will take place on the platform only if users sufficiently trust one another. Otherwise, users will form pessimistic expectations about the participation of other users and it is then very likely that no users will actually participate ...<sup>42</sup>

Marketplace unraveling due to a lack or loss of trust is exacerbated in the context of platforms, as network effects may accelerate the process in which buyers and sellers exit the platform in response to reputational loss.<sup>43</sup> Consider, as an illustrative example, an event that raises doubt over whether sellers on a platform can be trustworthy; for instance, a popular seller is exposed for selling counterfeit goods. Upon learning of this new information, many customers may stop trusting the platform and stop shopping on the platform, for fear that the goods sold by remaining sellers may also be counterfeits. As a result, remaining sellers will suffer a reputational externality, reducing their incentives to remain on the platform, and prospective sellers will be

<sup>40</sup> The Register, “Empty Playstation Box Sold for \$425,” February 2, 2001, [https://www.theregister.com/2001/02/02/empty\\_playstation\\_box\\_sold](https://www.theregister.com/2001/02/02/empty_playstation_box_sold) (“Bidding started at \$9.99 for the item, described as a ‘PlayStation 2 Original Box And Receipt’, on December 27. Over the three day online auction the gaming collectables, item number 1204183251, received 39 bids. They were eventually snapped up by ‘arturofuente 13’ for the bargain price of \$425 ... Tucked away in the comments on the Seller’s Feedback Profile she has written ‘Complaint: Buyer Beware!!! Misleading information about item. Paid \$425 for an empty box!’ To which the seller responded: ‘I sent what was promised in the auction. I do not rip people off. She’s a liar.’”).

<sup>41</sup> George Akerlof, “The Market for ‘Lemons’: Quality Uncertainty and the Market Mechanism,” *The Quarterly Journal of Economics*, Vol. 84, No. 3, 1970, pp. 488-500.

<sup>42</sup> Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, pp. 124-125.

<sup>43</sup> Catherine Tucker, “How Platforms Create Value Through Coring and Implications for Market Definition,” *CPI Antitrust Chronicle*, Vol. 2, No. 2, 2022, pp. 16-19, p. 18 (“Diminished trust will erode the number of interactions on the platform as well as the number of sellers and buyers. This will in turn erode indirect network effects and leave the platform at a disadvantage relative to other, better-managed platform competitors.”).

dissuaded from joining. In particular, even “one poor outcome may cause a buyer to update [their] beliefs about the quality of all sellers on the platform, resulting in a reputational externality across sellers.”<sup>44</sup>

27. Empirical studies confirm that lack or loss of trust can threaten platform success and, in some cases, cause complete unraveling. An empirical study of struggling or failed platforms cited the “failure to develop trust with users and partners” as one of the major mistakes made by platforms.<sup>45</sup> Platform economists therefore regard trust as a “vital building block” of platforms, noting that “a platform’s foremost responsibility is to establish a climate of trust among its participants.”<sup>46</sup> Trust is necessary for a platform to retain its users and is key to ensure the long-term success of the platform.<sup>47</sup>

28. Craigslist is an example of an online platform whose trust issues have hindered its ability to grow. Craigslist uses few, if any, of the coring activities commonly used by the platforms described in Section V.A. The platform has no screening protocols or rating systems, and only provides external resources for consumers looking to avoid or report scams. It provides no recourse for users that fall victim to fraud or scams; rather, it directs them to file complaints through external organizations, such as the FTC.<sup>48</sup> The platform’s lack of trust-related infrastructure has led to numerous news stories detailing instances of scams and quality issues,

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<sup>44</sup> Chris Nosko and Steven Tadelis, “The Limits of Reputation in Platform Markets: An Empirical Analysis and Field Experiment,” *NBER Working Paper 20830*, 2015, pp. 1-36, p. 1 (“[D]ecentralized sellers in platform markets do not internalize the impact of their actions on the marketplace as a whole. In particular, one poor outcome may cause a buyer to update his beliefs about the quality of *all* sellers on the platform, resulting in a reputational externality across sellers.”).

<sup>45</sup> David B. Yoffie, Annabelle Gawer, and Michael A. Cusumano, “A Study of More Than 250 Platforms Reveals Why Most Fail,” May 29, 2019, <https://hbr.org/2019/05/a-study-of-more-than-250-platforms-reveals-why-most-fail>.

<sup>46</sup> Paul Belleflamme and Nicolas Neysen, *Platform Strategies: A Guidebook for Entrepreneurs in the Platform Economy*, London, Routledge, 2023, p. 200.

<sup>47</sup> Paul Belleflamme and Nicolas Neysen, *Platform Strategies: A Guidebook for Entrepreneurs in the Platform Economy*, London, Routledge, 2023, pp. 199-200 (“You may be tempted to sit back and let positive feedback loops work their ‘snowballing magic’ for you. But – sorry to break the bad news – it is way too early to rest on your laurels .... Your next challenge is thus to consolidate your platform by retaining your users. This is key to ensuring the success of your platform in the long run ....”).

<sup>48</sup> Craigslist, “Avoiding Scams,” <https://www.craigslist.org/about/scams>.

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sometimes resulting in real harm to users.<sup>49</sup> For instance, a person selling Air Jordans was pepper-sprayed and robbed by potential buyers met on Craigslist,<sup>50</sup> and another had their \$350 Nike sneakers stolen after a buyer met on Craigslist threatened them with gun violence during the exchange.<sup>51</sup> These issues have inhibited the platform’s ability to maximize its potential to serve its users successfully.

29. The failure of eBay in China provides another example of the consequences of coreng failures. When it entered the Chinese ecommerce market in the early 2000s, eBay benefited from a first-mover advantage and was dominant. However, it relied on PayPal to process payments at the point of purchase, immediately transferring funds from buyer to seller. Alibaba later entered the market with a payment model whereby seller payment was contingent

<sup>49</sup> Ellen Airhart, “Why cashier’s checks are part of so many online scams,” *Vox*, August 19, 2019, <https://www.vox.com/the-goods/2019/8/19/20808526/cashiers-checks-online-scams> (“I think cashier’s checks are being used in a growing number of schemes,’ says Tejasvi Srimushnam, staff attorney for the Federal Trade Commission’s Bureau of Consumer Protection. These scams are common on Craigslist and other online marketplaces, and the number of fake check complaints to the FTC and the Internet Fraud Complaint Center doubled between 2014 and 2017 from 12,781 to 29,513, according to a report by the Better Business Bureau.”); Patch, “Bellevue Police Warn of Craigslist Moving Company Scam,” March 30, 2022, <https://patch.com/washington/bellevue/bellevue-police-warn-craigslist-moving-company-scam> (“Bellevue police are warning of a scam targeting residents who seek out moving services on Craigslist. The police department said the latest scam has been reported around the Puget Sound area, with the culprits posing as a reputable moving company, complete with a business license, address and phone number. However, once the ‘movers’ arrive and load up the truck with valuables, police said they demand victims pay a ransom to return the items, quoting a price four to five times higher than the agreed-upon cost. In one such case, Bellevue investigators said a victim refused to pay and the scammers left with an estimated \$40,000 worth of belongings.”).

<sup>50</sup> Burbank Leader, “Craigslist Seller Robbed by Would-be Buyers in Burbank,” January 22, 2014, <https://www.latimes.com/socal/burbank-leader/the818now/tn-blr-me-craigslist-seller-robbed-by-wouldbe-buyers-in-burbank-20140122-story.html> (“When the victim opened his trunk to retrieve the Air Jordans, one suspect pepper-sprayed him in the face, while the other grabbed the show box. The pair struggled over the box, until the victim, who was having trouble seeing, let go[.]”).

<sup>51</sup> KIRO7, “Craigslist Sneaker Sale Leads to Robbery at Northgate,” August 20, 2013, <https://www.kiro7.com/news/craigslist-sneaker-sale-leads-robbery-northgate/246518365> (“Hong ran after the man who had grabbed his shoes, but backed-off immediately when, according to police documents, the suspect said he ‘had a gun and will shoot him if he follows.’ Hong immediately called the Seattle police and a case was opened. Even though he’s sold at least 10 pairs of sneakers on Craigslist, Hong probably won’t do it again.”). See also CNN, “Craigslist Case: Teen Robbery Suspect Run Over, Loses Arm,” February 13, 2016, <https://www.cnn.com/2016/02/13/us/new-york-craigslist-robbery/index.html>; ABC30, “\$6,000 Pharrell x Adidas Sneakers Stolen From Irvine Man who Listed Them on Craigslist,” November 18, 2017, <https://abc30.com/pharrell-adidas-you-nerd-sneakers-stolen-irvine-shoes/2667604> (“A search is on for two thieves who stole a pair of limited edition Adidas sneakers worth \$6,000 from an Irvine man who was trying to sell them on Craigslist … the victim and the suspect met on Tuesday at the Irvine Market … When the victim entered the backseat of the suspect’s white BMW 3 Series, he was met by a second suspect, who produced a black semi-automatic handgun and pointed it at him. Investigators said the victim was ordered to get out of the car – and to leave the shoes behind. The suspects took off with the shoes as well as the victim’s cellphone.”).

on buyer satisfaction. This model was perceived as more trustworthy by Chinese consumers, many of whom promptly switched over to the new platform.<sup>52</sup> Ultimately, eBay did not survive competition from Alibaba due to these trust issues and exited the market in 2006.<sup>53</sup>

30. Coring failures also contributed to the downfalls of Friendster and Myspace, two early social media platforms. Friendster was launched in 2002 as a platform to introduce friends-of-friends for dating purposes and quickly amassed 300,000 users.<sup>54</sup> However, the platform failed due, in part, to changes to site features and functionality which, “signaled to some that the company did not share users’ interests” and created a “rupture of trust between users and the site.”<sup>55</sup> When Myspace launched in 2003, it offered users greater autonomy and flexibility in

<sup>52</sup> David B. Yoffie, Annabelle Gawer, and Michael A. Cusumano, “A Study of More Than 250 Platforms Reveals Why Most Fail,” *Harvard Business Review*, May 29, 2019, <https://hbr.org/2019/05/a-study-of-more-than-250-platforms-reveals-why-most-fail> (“One of the biggest failures in this category was eBay in China. eBay was the first mover, with a dominant share in China in the early 2000s. But Alibaba took over the market. The biggest source of the failure, confided the CEO of eBay China in an interview, was that ‘eBay’s single biggest problem... was trust.’ eBay relied on PayPal, which was designed as a payment system, much like a bank. For Chinese consumers unfamiliar with ecommerce, that was not enough. Alibaba’s Alipay used an escrow model (which did not release payment until the consumer was satisfied). This neutralized eBay’s early mover advantage, and Alibaba quickly captured the bulk of the market.”).

<sup>53</sup> Helen Wang, “How eBay Failed in China,” *Forbes*, September 12, 2010, <https://www.forbes.com/sites/china/2010/09/12/how-ebay-failed-in-china> (“By March 2006, [Alibaba’s] Taobao had outpaced eBay EachNet and became the leader in China’s consumer-to-consumer (C2C) market, with 67 percent market share in terms of users, while eBay EachNet had only 29 percent market share. ‘The competition is over,’ Ma exclaimed. ‘It’s time to claim the battlefield.’ On December 20, 2006, Meg Whitman, eBay’s then CEO, flew to Shanghai to take part in a press conference to announce a new joint venture ... It was, in reality, a formal announcement of eBay’s withdrawal from the online auction market in China.”).

<sup>54</sup> danah boyd and Nicole Ellison, “Social Network Sites: Definition, History, and Scholarship,” *Journal of Computer-Mediated Communication*, Vol. 13, No. 1, 2008, pp. 210-230, p. 215 (“Friendster launched in 2002 as a social complement to Ryze ... While most dating sites focused on introducing people to strangers with similar interests, Friendster was designed to help friends-of-friends meet, based on the assumption that friends-of-friends would make better romantic partners than would strangers (J. Abrams, personal communication, March 27, 2003). Friendster gained traction among three groups of early adopters who shaped the site—bloggers, attendees of the Burning Man arts festival, and gay men (boyd, 2004)—and grew to 300,000 users through word of mouth before traditional press coverage began in May 2003 (O’Shea, 2003).”).

<sup>55</sup> danah boyd and Nicole Ellison, “Social Network Sites: Definition, History, and Scholarship,” *Journal of Computer-Mediated Communication*, Vol. 13, No. 1, 2008, pp. 210-230, p. 215 (“As Friendster’s popularity surged, the site encountered technical and social difficulties (boyd, 2006b). Friendster’s servers and databases were ill-equipped to handle its rapid growth, and the site faltered regularly, frustrating users who replaced email with Friendster”), p. 216 (“The initial design of Friendster restricted users from viewing profiles of people who were more than four degrees away (friends-of-friends-of-friends-of-friends). In order to view additional profiles, users began adding acquaintances and interesting-looking strangers to expand their reach. Some began massively collecting Friends, an activity that was implicitly encouraged through a ‘most popular’ feature. The ultimate collectors were fake profiles representing iconic fictional characters: celebrities, concepts, and other such entities. These ‘Fakesters’ outraged the company, who banished fake profiles and eliminated the ‘most popular’ feature (boyd, in press-b). While few people actually created Fakesters, many more enjoyed surfing

designing their profiles, attracting former users of Friendster and a new, younger demographic that had never used Friendster.<sup>56</sup> However, Myspace’s laissez-faire environment was associated with safety issues,<sup>57</sup> and Facebook took over as the most popular social networking platform in 2008.<sup>58</sup> Facebook’s success has been credited to better coring practices, particularly in its early years:

Facebook started as a Harvard-only network, then expanded gradually, in stages, to other universities, high-schools, and corporate users, requiring a verified email address. This—and its clean and non-customizable design—allowed it to establish a reputation as a “safe space,” in contrast to MySpace.<sup>59</sup>

31. More recently, the “Blue Check Confusion” that arose when Twitter made changes to its account verification process provides an example of how coring affects platform users.<sup>60</sup> Back in 2009, Twitter launched its verified badge system, the blue check mark, to limit

Fakesters for entertainment or using functional Fakesters (e.g., ‘Brown University’) to find people they knew. The active deletion of Fakesters (and genuine users who chose non-realistic photos) signaled to some that the company did not share users’ interests. Many early adopters left because of the combination of technical difficulties, social collisions, and a rupture of trust between users and the site (boyd, 2006b.”); Productmint, “What Happened to Friendster? 4 Reasons Why it Failed,” <https://productmint.com/what-happened-to-friendster> (“Friendster failed because of site performance issues, rising competition, executive turnover, and due to extensive content moderation.”).

<sup>56</sup> danah boyd and Nicole Ellison, “Social Network Sites: Definition, History, and Scholarship,” *Journal of Computer-Mediated Communication*, Vol. 13, No. 1, 2008, pp. 210-230, p. 217 (“MySpace was able to grow rapidly by capitalizing on Friendster’s alienation of its early adopters … Teenagers began joining MySpace en masse in 2004. Unlike older users, most teens were never on Friendster—some joined because they wanted to connect with their favorite bands; others were introduced to the site through older family members.”).

<sup>57</sup> danah boyd and Nicole Ellison, “Social Network Sites: Definition, History, and Scholarship,” *Journal of Computer-Mediated Communication*, Vol. 13, No. 1, 2008, pp. 210-230, p. 217 “[After July 2005], safety issues plagued MySpace. The site was implicated in a series of sexual interactions between adults and minors, prompting legal action (Consumer Affairs, 2006). A moral panic concerning sexual predators quickly spread (Bahney, 2006), although research suggests that the concerns were exaggerated.”).

<sup>58</sup> Gil Press, “Why Facebook Triumphed Over All Other Social Networks,” *Forbes*, April 8, 2018, <https://www.forbes.com/sites/gilpress/2018/04/08/why-facebook-triumphed-over-all-other-social-networks> (“In April 2008, MySpace was overtaken by Facebook in terms of the number of unique worldwide visitors, and in May 2009, in the number of unique U.S. visitors. Why did Facebook become the largest and most dominant player in the social networking market?”).

<sup>59</sup> Gil Press, “Why Facebook Triumphed Over All Other Social Networks,” *Forbes*, April 8, 2018, <https://www.forbes.com/sites/gilpress/2018/04/08/why-facebook-triumphed-over-all-other-social-networks>.

<sup>60</sup> Rachel Lerman and Faiz Siddiqui, “Twitter’s Blue Check Mark was Loved and Loathed. Now it’s Pay for Play,” *The Washington Post*, March 31, 2023, <https://www.washingtonpost.com/technology/2023/03/31/twitter-verification-checkmark-ending> (“Twitter has been in a state of upheaval since Musk, who is also the CEO of Tesla and SpaceX, purchased the site he uses to communicate with his roughly 133 million followers on the

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accounts impersonating celebrities, among others. Twitter would verify the identity of the account user before giving them a badge, meaning that Twitter users could trust that Twitter had taken steps to ensure it considered the account to be legitimate.<sup>61</sup> In 2022, Twitter made the check mark subject to a monthly fee, and gave the badge to anyone willing to pay the fee without verifying their identity. As a result, accounts were set up that attempted to impersonate others, leading to the rollback of the program.<sup>62</sup> In December 2022, Twitter relaunched its paid verification program, with the additional requirement for users to register a phone number with Twitter to combat impersonations.<sup>63</sup> Until recently, paid verification existed alongside legacy blue check marks; that is, accounts that received a blue check for achieving a certain notoriety on the platform. However, in April 2023, Twitter began removing legacy check marks, affecting celebrities, politicians, news platforms, and other high-profile users.<sup>64</sup> Immediately, news outlets reported on “Twitter descend[ing] into chaos as news outlets and brands lose verification,” and “concerns that Twitter could lose its status as a platform for getting accurate, up-to-date information from authentic sources” as the verification check “lost all meaning.”<sup>65</sup>

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site. The self-described ‘free speech absolutist’ has said he wants to promote ‘free speech’ and further Twitter’s role as a public town square.”); Madison Malone Kircher, “Blue Check Confusion,” *The New York Times*, April 30, 2023, <https://www.nytimes.com/2023/04/30/briefing/twitter.html> (“Twitter’s check mark system wasn’t perfect, but it did make it easier for users to figure out if tweets were coming from a real person or organization ... Now users will have to work harder to make sure people are who they purport to be. I can attest that it’s harder than it sounds.”).

<sup>61</sup> Emma Bowman and Raquel Maria Dillon, “Twitter Begins Advertising a Paid Verification Plan for \$8 per Month,” *NPR*, November 6, 2022, <https://www.npr.org/2022/11/05/1134561542/twitter-blue-check-paid-verification-elon-musk> (“Since 2009, blue-checked accounts had been distributed to users through a verification process as a way to separate authentic accounts from impersonators.”).

<sup>62</sup> NBC News, “Twitter Pulls Paid Verification After Impersonators Flourish,” November 11, 2022, <https://www.nbcnews.com/tech/crypto/twitters-subscription-service-not-available-impersonators-flourish-rcna56730> (“Twitter has suspended sign-ups for its Blue subscription service after the initial rollout was marred by users who received a paid verification badge and then impersonated celebrities, politicians, and brands.”).

<sup>63</sup> Siladitya Ray, “Twitter Blue Subscription Service Relaunches Monday – Here’s Everything You Need to Know,” *Forbes*, December 11, 2022, <https://www.forbes.com/sites/siladityaray/2022/12/11/twitter-blue-finally-relaunches-on-monday-here-is-everything-you-need-to-know> (“Subscribers will need to register their phone number with Twitter in order to receive a blue verified badge, part of an effort to combat impersonator accounts that plagued the original rollout of Twitter Blue.”).

<sup>64</sup> CBS News, “Twitter Starts Removing Blue Check Marks From Users who Don’t Pay,” April 20, 2023, <https://www.cbsnews.com/news/twitter-blue-check-mark-removes-from-users-who-dont-pay> (“Twitter had about 300,000 verified users under the original blue-check system – many of them journalists, athletes, and public figures. The checks began disappearing from these users’ profiles late morning Pacific Time.”).

<sup>65</sup> CNN, “Twitter Descends into Chaos as News Outlets and Brands Lose Verification,” April 21, 2023, <https://www.cnn.com/2023/04/21/tech/twitter-verification-chaos/index.html> (“Twitter users awoke Friday

32. These examples underscore that StockX, like other similar platforms, has an incentive to ensure trust on its platform. StockX would risk the success of its business if it meaningfully tolerated sale of counterfeit items, which could lead to an erosion of trust on its platform.

*2. Successful marketplaces invest considerable resources in building and maintaining trust*

33. Building and maintaining trust is, and has been, important for the success of many marketplaces, and successful marketplaces devote considerable resources to coring. To stay effective, coring efforts may evolve over time as platforms learn about what strategies are most effective and also as new technologies emerge, which can aid these efforts. Coring efforts are a key way that firms compete in a competitive environment.<sup>66</sup> As illustrated by the following examples, specific policies and procedures used to build trust vary across marketplaces, depending on the marketplace characteristics and associated challenges, and evolve.

*a. Christie’s and Sotheby’s*

34. Two examples of successful marketplaces that devote resources to coring are Christie’s and Sotheby’s, leading auction houses founded in the 18<sup>th</sup> century that sell art, luxury

morning to even more chaos on the platform than they had become accustomed to in recent months under CEO Elon Musk after a wide-ranging rollback of blue check marks from celebrities, journalists and government agencies. The end of traditional verification marked the beginning of a radically different information regime on Twitter, one highlighted by almost immediate impersonations of government accounts; the removal of labels previously used to identify Chinese and Russian propaganda; and a scramble by the company to individually re-verify certain high-profile figures such as Pope Francis.”); Kari Paul, “Fake Accounts, Chaos and Few Sign-Ups: the First Day of Twitter Blue was Messy,” *The Guardian*, April 22, 2023, <https://www.theguardian.com/technology/2023/apr/21/elon-musk-twitter-blue-rollout>, (“The change has shifted the meaning of the check from an account that has been independently verified to one that paid a premium to help their tweets be seen by more people. … Many took advantage of the new verification-free world on Twitter by changing their profile pictures and names to impersonate prominent figures, from Amazon CEO Jeff Bezos to the late Arizona Senator, John McCain. Others made prank tweets posing as legitimate news accounts to spread misinformation making fun of Musk. The ability to pose as legitimate organizations and figures raised concerns that Twitter could lose its status as a platform for getting accurate, up-to-date information from authentic sources, including in emergencies.”).

<sup>66</sup> Catherine Tucker, “How Platforms Create Value Through Coring and Implications for Market Definition,” *CPI Antitrust Chronicle*, Vol. 2, No. 2, 2022, pp. 16-19, p. 18 (“Coring needs evolve as platforms compete, learn about what works, observe their competitors, and monitor evolving interactions on their platform. Continuous coring is particularly critical when a platform is facing competition.”).

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items, and collectibles such as sneakers in live auctions and online.<sup>67</sup> Both auction houses invest in rigorous screening protocols to maximize the chances of identifying counterfeit items. They rely on a team of in-house specialists tasked with authenticating items and offer multi-year warranties to further assuage concerns about authenticity.<sup>68</sup> Sotheby’s also has invested in authentication technology to detect high-level art forgeries. In 2016, it acquired Orion Analytical—a materials analysis firm specializing in the identification of forged artwork based on scientific techniques such as analytical chemistry, among others—and appointed its founder to lead a new Department of Science Research.<sup>69</sup> While these efforts are costly and sometimes

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<sup>67</sup> Christie’s, “About Us,” <https://www.christies.com/about-us/welcome-to-christies#About-UsAbout-Us> (“Founded in 1766, Christie’s is a world-leading art and luxury business. Renowned and trusted for its expert live and online auctions, as well as its bespoke private sales, Christie’s offers a full portfolio of global services to its clients, including art appraisal, art financing, international real estate and education.”); Sotheby’s, “The History of Sotheby’s Auction House,” <https://www.sothebys.com/en/about/our-history> (“Founded in 1744, Sotheby’s is the oldest and largest internationally recognized firm of fine art auctioneers in the world.”); Christie’s, “Handbags x HYPE: The Luxury Remix,” November 22, 2021, <https://www.christies.com/about-us/press-archive/details?PressReleaseID=10304&lid=1> (“Christie’s New York presents Handbags x HYPE: The Luxury Remix, a curated auction that reformulates our understanding of luxury today. … Leading the sale, we are proud to offer one of the most collectible pair of sneakers to ever come to market: a pair of game-worn and dual signed Air Jordan XIIIIs (\$300,000-500,000), from Michael Jordan’s last regular season game of the Chicago Bull’s championship season.”); Sotheby’s, “The Dynasty Collection: The Complete Set of Michael Jordan’s ‘Air Jordan’ Six Championship Sneakers,” February 27, 2023, <https://www.sothebys.com/en/articles/the-dynasty-collection-the-complete-set-of-michael-jordans-air-jordan-six-championship-sneakers> (“Sotheby’s is proud to present *The Dynasty Collection*, a set of 6 individual Air Jordan sneakers – each one worn by Michael Jordan in the clinching games of his 6 career NBA championships.”).

<sup>68</sup> Christie’s, “Buying at Christie’s,” <https://www.christies.com/buying-services/buying-guide> (“Every item we sell is meticulously researched by our world-class specialists, so when the sale approaches, you can bid confidently … Our specialists evaluate each item to ensure objects purchased through Christie’s are authentic.”); Christie’s, “Terms & Conditions,” <https://onlineonly.christies.com/terms-and-conditions/39> (“Subject to the terms and conditions of this paragraph, Christie’s warrants for a period of five years from the date of the auction that any property described in headings printed in UPPER CASE TYPE (i.e. headings having all capital-letter type) in the lot description (as such description may be amended by any saleroom notice or announcement) which is stated without qualification to be the work of a named author or authorship, is authentic and not a forgery.”); Sotheby’s, “Why buy with Sotheby’s,” September 29, 2022, <https://help.sothebys.com/en/support/solutions/articles/44002297454-why-buy-with-sotheby-s-> (“Our reputation for trust and authenticity is backed by our unparalleled global network of specialists spanning 40 countries and 44 departments.”); Sotheby’s, “Conditions of business for buyers for New York sales,” March, 2023, <https://www.sothebys.com/en/docs/pdf/conditions-of-business-for-buyers-for-new-york-sales-372023.pdf> (“We, as principal, provide an Authenticity Guarantee to the Buyer, subject to the following terms and conditions, that the Lot is not a ‘counterfeit.’”).

<sup>69</sup> CB Insights, “Orion Analytical,” <https://www.cbinsights.com/company/orion-analytical> (“Orion Analytical is a materials analysis and consulting firm that analyzes the chemical and structural composition of disputed artworks for clients around the world, including private collectors, museums, galleries, and the FBI.”); The Analytical Scientist, “Bringing Light to the Darkness,” August 11, 2017, <https://theanalyticalscientist.com/techniques-tools/bringing-light-to-the-darkness> (“This systematic use of particle, elemental, and molecular analyses provides information on different physical, optical, and chemical

imperfect, they nonetheless contribute to the auction houses’ trustworthy reputations and help buyers to feel confident spending millions of dollars for coveted art and luxury items.<sup>70</sup> The two auction houses occupy the top spots in multiple rankings of art auction houses worldwide, and, in 2022, brought in sales of \$8 billion each, over 4 times the sales of their largest competitor.<sup>71</sup>

b. eBay

35. Another example is eBay, which has invested in, and iterated on, several trust-building measures throughout its history. One such measure is the platform’s rating system. Rating systems can be useful in online marketplaces, as they allow users to draw on the collective experience of others in making judgments about a particular user rather than rely on

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features of materials. Used in combination, these analyses allow [Orion] to identify hundreds of thousands of materials, from an ancient pigment or alloy, to natural fibers, to modern synthetic polymers.”); Sotheby’s, “A Year of Scientific Research at Sotheby’s,” December 4, 2017, <https://www.sothbys.com/en/articles/a-year-of-scientific-research-at-sothebys> (“One year ago, Sotheby’s acquired Orion Analytical, the leading materials analysis and consulting firm in the art world, and hired its founder, Jamie Martin, to establish a Department of Scientific Research.”).

<sup>70</sup> Dalya Alberge, “Christie’s Caught up as £30m Forgeries Send Shock Waves Through the Art World,” *The Guardian*, October 16, 2010, <https://www.theguardian.com/artanddesign/2010/oct/17/christies-forgery-art-scandal>; Tom Sykes, “How Sotheby’s Got Hoodwinked: The Art World’s \$20m Forgery Scandal,” *The Daily Beast*, April 13, 2017, <https://www.thedailybeast.com/how-sothebys-got-hoodwinked-the-art-worlds-dollar20m-forgery-scandal> (“Sotheby’s, one of the two grand old firms of the global art world, and a key presence at Frieze, was forced into a humiliating admission that it is at the center of a multimillion-pound forgery scandal, involving what could be tens of millions of dollars worth of bogus Old Master paintings.”); Artistcloseup.com, “The Top 5 Art Auction Houses: A Guide to the World’s Most Prestigious Auctions,” March 1, 2023, <https://www.artistcloseup.com/blog/the-top-5-art-auction-houses> (“[Christie’s] has a reputation for selling the most valuable and prestigious artworks, including the recent sale of the Leonardo da Vinci painting, Salvator Mundi, for a record-breaking \$450 million … [Sotheby’s] has a reputation for high-end sales, such as the recent auction of the 1933 Saint Gaudens Double Eagle coin for \$18.9 million.”).

<sup>71</sup> Artistcloseup.com, “The Top 5 Art Auction Houses: A Guide to the World’s Most Prestigious Auctions,” March 1, 2023, <https://www.artistcloseup.com/blog/the-top-5-art-auction-houses> (“There are numerous art auction houses across the globe, but the top 5 are Christie’s, Sotheby’s, Phillips, Bonhams, and Heritage Auctions.”); The Collector, “Top 5 Auction Houses in the World,” August 8, 2019, <https://www.thecollector.com/top-5-auction-houses-in-the-world>; Robb Report, “The Big 3 Auction Houses Brought in Nearly \$18 Billion in Sales This Year,” December 27, 2022, <https://robbreport.com/lifestyle/news/auction-houses-2022-sales-1234789287> (“In 2022, Christie’s brought in \$8.4 billion in sales, while Sotheby’s reached \$8 billion and Phillips made \$1.3 billion.”); Statista, “Leading Auction Houses Worldwide in 2022, by Sales Value,” <https://www.statista.com/statistics/1285570/leading-auction-houses-worldwide-by-sales-value> (“That year, the company’s total sales from public and private channels amounted to roughly 8.4 billion U.S. dollars. Sotheby’s had the second-highest sales value that year, at around eight billion U.S. dollars. Other major auction houses, such as Heritage Auctions, Phillips, and Bonhams, reported less than 1.5 billion U.S. dollars in sales in 2022.”).

their own, more limited, experience alone.<sup>72</sup> Shortly after launching in 1995, eBay introduced a rating system, which allowed users to provide feedback on any user regardless of whether they had sold or purchased from each other.<sup>73</sup> Since then, the platform has made improvements to its rating system to address issues related to unfair bias in feedback and retaliation against buyers leaving negative reviews. In 2000, eBay switched to a transaction-based feedback model and, in 2007, eBay introduced anonymous “Detailed Seller Ratings”—which are published only in aggregate form—to accompany classic and identifiable ratings for sellers.<sup>74</sup> Today, users of the platform have feedback profiles, which include an overall feedback score, the share of the user’s ratings that are positive, and recent written feedback.<sup>75</sup> In addition to leaving feedback, users also have the option to report especially poor behavior through a separate reporting system.<sup>76</sup> Sellers who fail to meet minimum performance standards risk limitations and, in extreme cases, bans on

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<sup>72</sup> Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, p. 48 (“The key issue here is trust: Should buyers trust the quality claims that sellers make about their products and services on offer? In a bilateral relationship between buyers and sellers, such trust problems can be solved through repeated interaction. But in anonymous markets, alternative solutions need to be found. Rating and review systems (or “reputation systems”) provide such an alternative: They serve as a substitute for personal experience by letting individual buyers draw on the collective experience of other buyers.”).

<sup>73</sup> Tobias J. Klein, Christian Lambertz, and Konrad O. Stahl, “Market Transparency, Adverse Selection, and Moral Hazard,” *Journal of Political Economy*, Vol. 124, No. 6, 2016, pp. 1677-1713, p. 1681 (“In February 1996, just a few months after the first auction had taken place on its website, eBay introduced its feedback mechanism. In its earliest form, the system allowed any eBay user to leave feedback on the performance of any other user independently of any transaction, in the form of a ‘positive,’ ‘neutral,’ or ‘negative’ rating, possibly accompanied by a textual comment. This feedback was immediately observable on his or her feedback profile page, together with all ratings and comments that a user had ever received by other users.”).

<sup>74</sup> Tobias J. Klein, Christian Lambertz, and Konrad O. Stahl, “Market Transparency, Adverse Selection, and Moral Hazard,” *Journal of Political Economy*, Vol. 124, No. 6, 2016, pp. 1677-1713, pp. 1681-1682 (“In May 2007, eBay introduced a new form of unilateral buyer ratings: detailed seller ratings (DSRs). In addition to the original bilateral rating, buyers could now separately rate, with one to five stars, the accuracy of the item description, communication, shipping speed, and shipping charges. They are made anonymous by being published in aggregate form only, provided that at least 10 ratings have been left in the last 12 months, so that the seller cannot identify the individual rating.”).

<sup>75</sup> eBay, “Feedback profiles,” <https://www.ebay.com/help/account/changing-account-settings/feedback-profiles?id=4204> (“On the feedback profile page, you’ll see a member’s: Overall feedback score[;] Percentage of positive ratings[;] Recently received feedback[;] Detailed seller ratings[;] eBay registration date.”).

<sup>76</sup> eBay, “Report an Issue With a Buyer,” <https://www.ebay.com/help/selling/resolving-buyer-issues/reporting-issue-buyer?id=4084> (“If you’re having a problem with a buyer because they’re not following our rules, let us know and we’ll look into it.”); eBay, “Report an Issue With a Seller,” <https://www.ebay.com/help/buying/resolving-issues-sellers/reporting-item-issue-seller?id=4022> (“If you have a problem with a seller because they’re not following our policies, let us know and we’ll look into it.”).

their activity.<sup>77</sup> Similarly, buyers engaged in misconduct may be banned by individual sellers or suspended from eBay as part of eBay’s “Abusive Buyer Policy.”<sup>78</sup> As described on its website, eBay sees the feedback process as allowing users of the platform to “buy and sell with confidence.”<sup>79</sup>

36. However, the informativeness of ratings is limited by several factors. First, ratings can be noisy. Noisy ratings may arise when buyers cannot easily judge the quality of their purchase, when buyers misunderstand the review process and provide irrelevant information,<sup>80</sup> or when buyers have idiosyncratic tastes and experiences. While such issues are mitigated by larger numbers of reviews, providing feedback is costly in terms of time and effort. It therefore takes considerable time to build a reputation. Furthermore, when providing feedback is optional—as is the case on eBay—ratings will only reflect the experience of a select sample of respondents. Indeed, research has shown that seller ratings on eBay are positively skewed and do not reflect the full spectrum of buyer experience.<sup>81</sup> Research has found that ratings for hosts and guests on

<sup>77</sup> eBay, “Seller standards policy,” <https://www.ebay.com/help/policies/selling-policies/seller-standards-policy?id=4347> (“If your account has been evaluated as Below Standard for more than 2 consecutive months: We may downgrade your Store to the Basic level … We may place selling restrictions on your account and related accounts, or restrict you from registering a new account … In addition to the above, we may take action at any time if we have urgent concerns about your account; for example, if we’ve detected fraud or if your selling practices pose a threat to the buyer experience. The actions we take will be proportional to the nature of the issue we have identified and what is reasonably required to protect the interests of all eBay users and eBay as provider of the services.”)

<sup>78</sup> eBay, “Blocking a Buyer on eBay,” <https://www.ebay.com/help/selling/resolving-buyer-issues/blocking-buyer-ebay?id=4082> (“eBay sellers have control over who can bid on and buy their items. You can block individual buyers or set buyer requirements based on specific criteria.”); eBay, “Abusive Buyer Policy,” <https://www.ebay.com/help/policies/rules-policies-buyers/abusive-buyer-policy?id=4374> (“Activity that doesn’t follow eBay policy could result in a range of actions including for example: administratively ending or canceling listings, hiding or demoting all listings from search results, lowering seller rating, buying or selling restrictions, and account suspension.”).

<sup>79</sup> eBay, “Feedback profiles,” <https://www.ebay.com/help/account/changing-account-settings/feedback-profiles?id=4204>.

<sup>80</sup> Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, p. 54 (“[T]his applies to product ratings on Amazon. Here, some reviewers do not base their rating on the quality and characteristics of the product they bought but on such factors as Amazon’s delivery service, which can be considered orthogonal to the product sold by Amazon.”).

<sup>81</sup> Chris Nosko and Steven Tadelis, “The Limits of Reputation in Platform Markets: An Empirical Analysis and Field Experiment,” *NBER Working Paper 20830*, 2015, pp. 1-36 p. 9 (“[T]he median seller has a score of 100%. This could be indicative of a reputation system that works extremely well – bad sellers exit when their score falls even slightly, leading to a high positive selection. Unfortunately, this is not the case. Out of over 44 million transactions completed in October of 2011 on eBay’s U.S. marketplace, only 0.39% had negative feedback, while at the same time, over 1% had an actual dispute ticket opened, a step that takes substantially

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Airbnb are similarly positively skewed, with some guests submitting high ratings even for hosts for whom they separately indicated not recommending.<sup>82</sup> Ratings may also be distorted by seller manipulation. For instance, Fakespot, a fraudulent review detection service, found that 42% of the 720 million Amazon reviews written in 2020 were not genuine.<sup>83</sup> Review brokers offer sham reviews and download services to app developers looking to boost their visibility in the Apple and Google app stores.<sup>84</sup> The harm of fake positive reviews can be exacerbated by herding behavior, in which positive fake reviews attract disproportionately more positive reviews and negative experiences go unreported.<sup>85</sup>

37. Recognizing the shortcomings of ratings and review systems, eBay has instituted several other practices to build trust on the platform. For example, eBay scans and analyzes the contents of messages for evidence of fraudulent activity.<sup>86</sup> In 2017, eBay moved to provide authentication services for luxury items, citing the desire “to boost customer confidence in

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more effort on a buyer’s part than leaving negative feedback. Furthermore, over 3.3% of messages from buyers to sellers post the transaction include language that imply a bad buyer experience ... This indicates that there are a substantial number of transactions that went badly for which negative feedback was not left.”).

<sup>82</sup> Andrey Fradkin, Elena Grewal, David Holtz, and Matthew Pearson, “Bias and Reciprocity in Online Reviews: Evidence From Field Experiments on Airbnb” presented at EC ’15: Proceedings of the Sixteenth ACM Conference on Economics and Computation (Cambridge, MA, July 15, 2015) p. 8 (“As expected, the distribution of ratings for guests who do not recommend is lower than the distribution of ratings for those that do recommend. However, in over 20% of cases where the guest does not recommend the host, the guest submits a four or five star rating.”).

<sup>83</sup> Matt Stieb, “Amazon’s War on Fake Reviews,” *Intelligencer*, July 26, 2022, <https://nymag.com/intelligencer/2022/07/amazon-fake-reviews-can-they-be-stopped.html> (“According to the fraudulent-review-detection service Fakespot, around 42 percent of 720 million Amazon reviews assessed in 2020 were bogus.”).

<sup>84</sup> Yahoo!Finance, “Revealed: Apple App store and Google Play flooded with fake reviews,” March 8, 2023, <https://uk.finance.yahoo.com/news/apple-app-store-google-play-flooded-with-fake-reviews-000126788.html> (“Review broker services for apps offer bulk downloads, reviews or upvotes to help push apps up the rankings ... One fake review broker site, reviewlancer, claims to have sold nearly 53,000 reviews and exchanged more than 130,000 reviews between apps.”).

<sup>85</sup> Paul Belleflamme and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021, p. 59 (“[P]aid-for fake positive reviews can generate positive herding on B2C and C2C platforms. Thus, the damage done from a positive fake review would not be corrected if the fake report were not removed immediately but at some later time”).

<sup>86</sup> eBay, “User Agreement,” [www.ebay.com/help/policies/member-behaviour-policies/user-agreement?id=4259#4](http://www.ebay.com/help/policies/member-behaviour-policies/user-agreement?id=4259#4) (“eBay’s automated systems scan and analyze the contents of every message sent through its messages platform, including messages between users, to detect and prevent fraudulent activity or violations of eBay’s User Agreement, including the incorporated terms, notices, rules, and policies. This may result in a manual review of messages sent through our messaging tools. This scanning and analysis may occur before, during, or after the message is sent, or while in storage, and may result in your message being delayed or withheld. eBay may store message contents, including to conduct this scanning and analysis.”).

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selling and shopping for an amazing selection of designer merchandise.”<sup>87</sup> The authentication services started with handbags, but have since expanded to include sneakers, jewelry, watches, and trading cards. With eBay’s “Authenticity Guarantee,” qualifying items are verified by eBay’s in-house team of experts before being shipped to the buyer.<sup>88</sup> The “Authenticity Guarantee” is now a key piece of eBay’s trust-building efforts, as illustrated by eBay’s promotion of the service through a 30-second ad spot in December 2022.<sup>89</sup> Nearly all purchases on eBay, including but not limited to purchases of luxury items, are also protected by eBay’s “Money Back Guarantee” policy.<sup>90</sup> Under this policy, buyers who receive a product inferior to what was advertised—such as a box filled with stones in lieu of a plasma TV—are entitled to a refund upon return of the product, regardless of whether the seller offers returns.<sup>91</sup>

c. *StockX*

38. Resale marketplaces for rare sneakers and other luxury items, including StockX and its competitors, have similarly recognized the importance of building trust and therefore have instituted verification processes for the products sold on their platforms. This section

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<sup>87</sup> PRNewswire, “Launch of eBay Authenticate Boosts Shopper Confidence for Luxury Handbag Purchases,” October 16, 2017, <https://www.prnewswire.com/news-releases/launch-of-ebay-authenticate-boosts-shopper-confidence-for-luxury-handbag-purchases-300536921.html>

<sup>88</sup> eBay, “Authenticity Guarantee,” <https://pages.ebay.com/authenticity-guarantee> (“Our team of authenticators brings years of industry knowledge to verifying your purchase … Your item is carefully inspected inside and out to make sure it’s authentic and matches the listing … Once it’s authenticated, we send your item your way via expedited shipping at no extra cost to you.”).

<sup>89</sup> The Drum, “US Ad of the Day: eBay Rejects Fake Followers & Fake News in Favor of Real Luxury Goods,” December 19, 2022, <https://www.thedrum.com/news/2022/12/19/us-ad-the-day-ebay-rejects-fake-followers-fake-news-favor-real-luxury-goods>.

<sup>90</sup> eBay, “eBay Money Back Guarantee policy,” <https://www.ebay.com/help/policies/ebay-money-back-guarantee-policy/ebay-money-back-guarantee-policy?id=4210> (“eBay Money Back Guarantee means you’re protected if the item you ordered didn’t arrive, is faulty or damaged, or doesn’t match the listing. You’ll get your money back.”).

<sup>91</sup> Zach Church, “Platform Strategy, Explained,” *MIT Sloan*, June 16, 2017, <https://mitsloan.mit.edu/ideas-made-to-matter/platform-strategy-explained> (“‘People were selling plasma TV boxes with stones in them,’ Tucker says.”); eBay, “eBay Money Back Guarantee policy,” <https://www.ebay.com/help/policies/ebay-money-back-guarantee-policy/ebay-money-back-guarantee-policy?id=4210> (“eBay Money Back Guarantee means you’re protected if the item you ordered didn’t arrive, is faulty or damage, or doesn’t match the listing. You’ll get your money back. For all the details of how the eBay Money Back Guarantee works, please see our full policy guidelines below.”).

describes StockX’s coring efforts and, specifically, the steps it takes to ensure a safe and reliable consumer experience.

39. StockX has invested in making trust the core of its brand identity, as reflected in the language used on its website. StockX explains, “At StockX, our mission is to provide a safe and secure experience for buying and selling the world’s most coveted items of current culture” and, “We handle everything to make sure you can buy and sell with confidence.”<sup>92</sup>

40. StockX relies on various features and technologies to increase trust and accountability on the platform. One of StockX’s most salient trust-building features is its verification process and the accompanying “StockX Verified” label for all products sold on its platform.<sup>93</sup> StockX verifies branded products before they are shipped to customers, thereby minimizing counterfeit risk: a problem plaguing both offline and online trades of such items.<sup>94</sup> StockX’s multi-step and proprietary verification process aims to give buyers confidence that there is no evidence the product has a defect or is not genuine.<sup>95</sup> This assurance is reflected in this quote from a StockX user:

StockX did a great job making me feel safe and sending a fully vetted product. They made it easy to know their process and what step of the process you are in at any time. Great experience, I would most definitely use them again and recommend them to anyone who is looking to buy shoes that are out of stock elsewhere.<sup>96</sup>

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<sup>92</sup> StockX, “What is the StockX Buyer Promise?,” April 17, 2023, <https://stockx.com/help/articles/What-is-the-StockX-Buyer-Promise>; StockX, “The Current Culture Marketplace,” <https://stockx.com/about/how-it-works/>.

<sup>93</sup> StockX, “Every item is StockX Verified.,” <https://stockx.com/about/verification> (“Every item is StockX Verified. Shop on StockX with confidence knowing every purchase is StockX Verified. StockX Verified is our own designation and not endorsed by any brands sold on StockX.”).

<sup>94</sup> Roberto Fontana, Stéphane J.G. Girod, and Martin Králik, “How Luxury Brands Can Beat Counterfeitors,” May 24, 2019, <https://hbr.org/2019/05/how-luxury-brands-can-beat-counterfeitors> (“The total trade in fakes is estimated at around \$4.5 trillion, and fake luxury merchandise accounts for 60% to 70% of that amount, ahead of pharmaceuticals and entertainment products and representing perhaps a quarter of the estimated \$1.2 trillion total trade in luxury goods. Digital plays a big role in this and perhaps 40% of the sales in luxury fakes take place online, as today’s counterfeiters milk the ubiquity and anonymity of the internet space to the last drop.”).

<sup>95</sup> StockX, “Every item is StockX Verified.,” <https://stockx.com/about/verification> (“Our global team of experts uses a rigorous, multi-step verification process … We leverage machine learning to assess product risk and ever-evolving embedded technologies within the products to enhance our verification efforts. A final check in our verification process, our QA [quality assurance] experts ensure the product meets our high standards.”).

<sup>96</sup> TrustPilot, “StockX,” <https://www.trustpilot.com/review/stockx.com?stars=5>.

41. StockX also offers a Buyer Promise to make buyers feel more confident purchasing on the platform. StockX’s Buyer Promise covers buyers within a certain timeframe of receiving an item if they believe StockX made a mistake with their order, including incorrectly verifying the product.<sup>97</sup> StockX users can also receive personalized support from StockX’s Help Center for any issues they may encounter while using the platform.<sup>98</sup>

42. StockX works on ensuring that only reliable buyers and sellers use the platform. StockX provides a uniform product page on which items are listed for sale,<sup>99</sup> and sellers who repeatedly do not complete sales or send in items that fail verification are liable to have their accounts suspended.<sup>100</sup> Account suspension will also occur for buyers who issue chargebacks with their financial institution without expressing concern of fraud with StockX first.<sup>101</sup>

43. To further ensure marketplace integrity and prevent fraud, StockX works with partners such as Auth0, a provider of secure logins and account authentication services. StockX also works with Riskified, a provider of fraud management software for eCommerce, and Braintree, a provider of secure payment processing solutions.<sup>102</sup>

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<sup>97</sup> StockX, “What is the StockX Buyer Promise?,” April 17, 2023, <https://stockx.com/help/articles/What-is-the-StockX-Buyer-Promise> (“The StockX Buyer Promise solidifies this mission by providing support for Buyers should we make a mistake (e.g. we ship you the wrong order, we incorrectly verify an item.”).

<sup>98</sup> StockX, “The Current Culture Marketplace,” <https://stockx.com/about/how-it-works/> (“Thanks to our Help Center, Chatbot, and dedicated global-support staff, you can be sure that we are always available to answer any and every question regarding our marketplace.”).

<sup>99</sup> StockX, “The Current Culture Marketplace,” <https://stockx.com/about/how-it-works/> (“[N]o taking photos, no writing catchy descriptions, and no dealing with rogue buyers or sellers. We handle everything to make sure you can buy and sell with confidence.”).

<sup>100</sup> StockX, “Why is My Account on Hold?,” April 10, 2023, <https://stockx.com/help/articles/Why-can-t-I-access-my-account> (“As a Seller, repeated incomplete sales are the most common reason why your account might be suspended. Failure to send items out for verification and failure to send items that pass the StockX verification process will result in penalty fees and eventually suspension, depending on the number of failures and their severity.”).

<sup>101</sup> StockX, “Why is My Account on Hold?,” April 10, 2023, <https://stockx.com/help/articles/Why-can-t-I-access-my-account> (“As a Buyer, issuing a chargeback with your financial institution will suspend your account. It is always recommended in the case of suspected account fraud and accidental purchases that you contact StockX Support before asking your financial institution for a chargeback.”).

<sup>102</sup> StockX, “The Current Culture Marketplace,” <https://stockx.com/about/how-it-works/> (“Preserving the integrity of our marketplace means staying a step ahead. Our security and fraud systems, powered by our world class partners, have your personal information covered 24/7.”); Auth0, “About,” <https://auth0.com/about>; Riskified, “Riskified,” <https://www.riskified.com>; Braintree, “Braintree,” [www.braintreepayments.com](http://www.braintreepayments.com).

44. StockX also builds trust into transactions by providing buyers and sellers with data so that neither feels like they traded at an unfair price on the platform. This feature of StockX has been described as part of “The Stock[X] formula” as follows:

[StockX] ensures that prices remain somewhat in check. When buying a sneaker, you can get insight into the rises and falls of the prices. In this way, the company remains transparent about the prices and you get insight into the market value of your pair.<sup>103</sup>

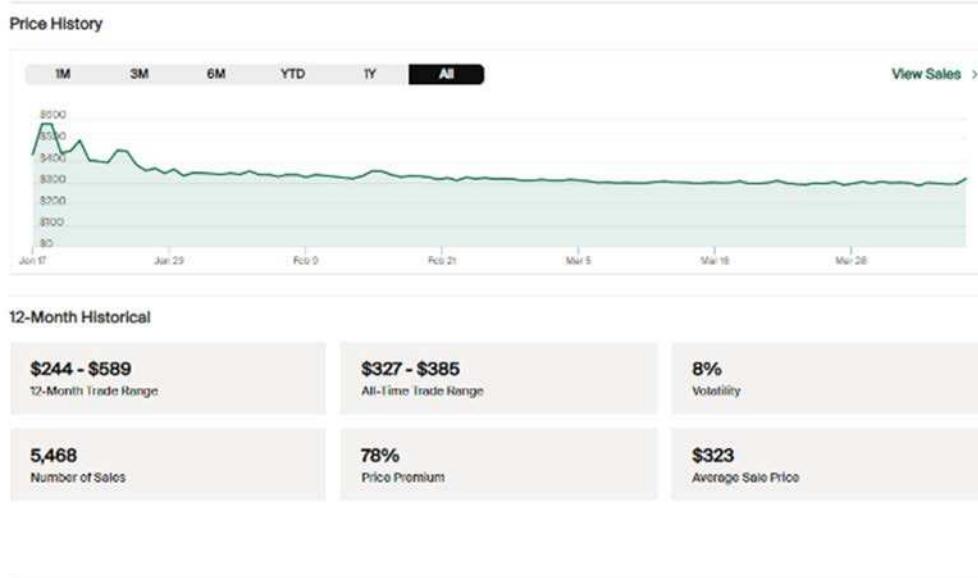
45. Each product listing includes historical price data, as well as the 12-month trade range, all-time trade range, price volatility, number of sales, price premium, and average sale price, as illustrated in Exhibit 1. Such information on current and past prevailing prices of certain products helps buyers avoid overpaying for a purchase on the platform. It may also help them identify instances where a price offered is too low to be credible because the sneakers are counterfeit. A range of community forums and websites warn to watch out for low prices. For example, sneakerflippers.com advises traders that “[o]ne of the easiest ways to tell if a pair of sneakers is fake is to check the price. In general, authentic sneakers are very expensive, while fake sneakers are much cheaper. So if you’re looking at a pair of sneakers and the price seems too good to be true, that’s a good sign that the sneakers might be fake.”<sup>104</sup>

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<sup>103</sup> Sneaker Jagers, “How StockX Became the Biggest Sneaker Marketplace,” September 30, 2021, <https://www.sneakerjagers.com/en/n/how-stockx-became-the-biggest-sneaker-marketplace/27074>.

<sup>104</sup> Sneaker Flippers, “How to Identify Real vs Fake Sneakers,” April 17, 2022, <https://sneakerflippers.com/tips/reselling/identify-real-fake-sneaker>. See also Shoemakers Academy, “How to Spot Fake Air Jordans,” <https://shoemakersacademy.com/air-jordan-legit-check> (“When shopping for real Nike shoes you should expect to pay real Nike prices. If you find a rare Air Jordan or a unique color at a price that is too good to be true... then it IS too good to be true. Low prices and beat up boxes are your first clue that you have a fake, counterfeit, or illegally smuggled-in B-grade Nike shoe.”), Fast Cop, “How to Spot Fake Sneakers: Complete Guide,” <https://fastcop.com/how-to-spot-fake-sneakers/> (“The most obvious sign that an online store is selling fake sneakers is if their prices are too good to be true. Similar to other items sold online, a hard to believe price is often a good indication that you might not get the authentic or original version of the product you’re looking to buy.”).

### Exhibit 1: Example Pricing Data for Product Listed on StockX



*d. Other platforms*

46. GOAT, an online platform specializing in the resale of sneakers, streetwear, and luxury apparel, operates a similar system to StockX. Like StockX, GOAT verifies the products traded on its platform after a purchase has taken place and relies on both a team of experts and technologies like digital authentication and machine learning to issue an “Assurance of Authenticity” to buyers.<sup>105</sup> In addition, similar to StockX’s Buyer Promise, GOAT offers a Buyer Protection Policy, whereby buyers can receive a refund if there is a mistake with their order.<sup>106</sup>

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<sup>105</sup> GOAT, “What is the Assurance of Authenticity?,” 2023, <https://support.goat.com/hc/en-us/articles/115004608127-What-is-the-Assurance-of-Authenticity-> (“Additionally, our resale products and our trusted partners are verified or vetted by a variety of means, such as digital authentication, in-hand verification, and/or machine learning technology.”); ZDNet, “GOAT Uses Machine Learning, Computer Vision to Verify Your Top Dollar Sneakers Are Authentic,” August 19, 2018, <https://www.zdnet.com/article/goat-uses-machine-learning-computer-vision-to-verify-your-top-dollar-sneakers-are-authentic> (“[W]hen that shoe is purchased, the seller ships it to us to verify. And we verify that product the same day using our sophisticated machine learning and computer vision, and our industry knowledge. And release the funds to the seller. And then we ship that product to the buyer to purchase.”).

<sup>106</sup> GOAT, “Buyer Protection Policy,” <https://www.goat.com/buyer-protection-guarantee> (“In the event the item you received qualifies for a return under one of the scenarios listed above, we will provide you with a shipping label to be used to send the item to GOAT ... If your item is approved under this policy, you will receive a refund in GOAT Credit in the amount of your total purchase.”).

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47. Other competitors such as Flight Club and Stadium Goods, follow a consignment model where product authentication happens before products are listed for sale.<sup>107</sup> Stadium Goods’ verification process relies predominantly on in-person inspections of sneakers by trained staff, but it also relies on “a variety of technical methods to ensure [the] inventory’s authenticity.”<sup>108</sup> On Flight Club, all shoes are authenticated and verified by a team of trained specialists.<sup>109</sup>

48. Chrono24, a digital marketplace for both new and used watches, takes a different approach to building trust on its platform. Unlike other resale platforms, sellers on Chrono24 ship watches directly to buyers. Because Chrono24 does not physically verify a given watch’s authenticity before it changes hands, Chrono24 has developed other tools to build trust. For watches sold by professional dealers, Chrono24 provides a binding Authenticity Guarantee.<sup>110</sup> Listings for watches sold by private sellers, however, must pass inspection by Chrono24 prior to their publication on the platform and are subject to further review by a dedicated 40-person team scanning the platform for suspicious listings.<sup>111</sup> Finally, buyers have the option to use Chrono24’s escrow service for payments, which ensures that a seller is only paid once the buyer receives their purchase.<sup>112</sup>

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<sup>107</sup> Niche Pursuits, “Is Flight Club legit? Get all the info to help you decide,” November 2, 2022, <https://www.nichepursuits.com/is-flight-club-legit> (“Flight Club sells new products sourced through retail channels and second-market goods using the consignment model. Sellers send in their shoes, and Flight Club verifies the sneakers before marketing them online or in one of three stores.”); Stadium Goods, “Is Stadium Goods Legit?,” December 20, 2022, <https://www.stadiumgoods.com/en-us/article/is-stadium-goods-legit> (“Stadium Goods is the only aftermarket that pre-authenticates its entire inventory.”).

<sup>108</sup> Stadium Goods, “Authenticity,” <https://www.stadiumgoods.com/en-us/authenticity>.

<sup>109</sup> Flight Club, “How is Flight Club Different From Other Footwear Retailers?,” 2020, <https://support.flightclub.com/hc/en-us/articles/360037122132-How-is-flight-club-different-from-other-footwear-retailers>, (“All shoes are authenticated and verified to be as described by our team of trained specialists”).

<sup>110</sup> Chrono24, “Chrono24 - Guarantee of Authenticity,” <https://www.chrono24.com/info/guarantee-of-authenticity.htm> (“The following Guarantee of Authenticity only applies to watches purchased from professional dealers on this platform. Private sellers are not subject to the Guarantee of Authenticity.”).

<sup>111</sup> Chrono24, “Discover the Safest Path to Your Dream Watch,” <https://www.chrono24.com/about-us.htm> (“Each private seller listing must pass an inspection before we publish it on our platform. As part of the inspection, the seller must provide proof of ownership in the form of two pictures of the watch set to specific times.”; “Our 40-person quality & security team works hard to detect suspicious listings and address issues before they arise, allowing you to focus on what’s most important – finding the right watch!”).

<sup>112</sup> Chrono24, “Discover the Safest Path to Your Dream Watch,” <https://www.chrono24.com/about-us.htm>, (“Chrono24 provides Escrow Service for free. Payment is transferred and kept safe in Chrono24’s escrow

49. CardTrader is a platform where users can buy and sell collectible game cards, such as Magic, Pokémon, and Digimon. While many cards are traded for less than a dollar, rare cards can trade for thousands of dollars.<sup>113</sup> CardTrader recently introduced the CTZero program, through which CardTrader stores and verifies cards at a central facility before shipping them on to a buyer.<sup>114</sup> Buyers can feel confident in their purchase due to the CTZero Total Safeguard service, where card purchases are verified by CardTrader’s quality assurance team, and, if a card does not meet quality standards, it is either replaced by CardTrader at no additional cost to the buyer or the buyer can purchase the lower quality item at a discounted price.<sup>115</sup> Sellers participating in the CTZero program benefit from this service as well, as it allows them to avoid costly buyer disputes and non-compliance.<sup>116</sup> Finally, with CTZero Total Safeguard, CardTrader users also have access to an extra level of 24/7 customer support to help with any buying and selling concerns.<sup>117</sup>

50. The prevalence of coring efforts across platforms is evidence of their importance to platform success. Specific efforts will vary across platforms—depending on factors such as the nature of the products and/or services sold—and over time as market conditions change. However, what matters is that platforms continue to invest in such efforts and maintain user trust.

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account until you have your watch in your hands. We keep your payment safe in our escrow account for up to 7 days after the day of delivery of your watch and we release your payment to the private seller.”).

<sup>113</sup> See, for example, CardTrader, “Mox Ruby,” <https://www.cardtrader.com/en/cards/mox-ruby-limited-edition-alpha>; CardTrader, “Charizard,” <https://www.cardtrader.com/en/cards/charizard-holo-rare-4-102-base-set-shadowless>.

<sup>114</sup> CardTrader, “CardTrader Zero,” <https://www.cardtrader.com/pages/zero> (“CardTrader Zero is simple and intuitive: Buy cards from around the world without paying for shipments. We collect all your cards like a PO Box. Pay only one shipment when you decide to redeem the cards you have collected.”).

<sup>115</sup> CardTrader, “CardTrader Zero,” <https://www.cardtrader.com/pages/zero> (“Your purchases will be verified by our team, ensuring precision and efficiency … Whenever an item is discarded by our quality control team we will replace it for you with no additional costs.”); CardTrader, “CardTrader Zero Terms of Service for Sellers,” <https://www.cardtrader.com/pages/ct-zero-terms-of-service> (“Buyers can set a threshold for non-compliant articles … if they receive a non-compliant article sold within this threshold, the will repurchase it anyway at a discounted price.”).

<sup>116</sup> CardTrader, “CardTrader Zero,” <https://www.cardtrader.com/pages/zero> (“No disputes. Non compliances, delays and loss of packages are entirely handled by our staff and automated system.”).

<sup>117</sup> CardTrader, “CardTrader Zero,” <https://www.cardtrader.com/pages/zero> (“24/7 Customer care. Our team is always ready to answer questions, feel free to contact us at any time, we work 24/7.”).

## VI. VAULT NFTS ARE A TECHNOLOGY TO FURTHER FACILITATE TRANSACTIONS ON THE STOCKX PLATFORM

51. As marketplaces’ *raison d’être* is to facilitate transactions between buyers and sellers through the reduction of search, information, and transaction costs, they have an incentive to invest in features and technologies that reduce these costs. Since trading physical assets can be costly due to transportation, storage, and quality verification processes, multiple features and technologies have been developed throughout recent history to facilitate their trade, including the following three: (1) untethering ownership from physical possession, for instance through the blockchain and physical NFTs; (2) innovations that reduce information costs through reduced verification costs, and (3) storage solution vaults that improve the tradability of physical goods.

52. StockX’s Vault NFTs are an innovation that incorporates these three features. Trading physical goods can be costly because, to complete a sale on StockX, the seller must ship the product to StockX, then StockX must verify the product and ship the product to the buyer. Vault NFTs, digital tokens tied to the verified physical goods stored in StockX’s vault, help eliminate some of these steps. As a result, StockX’s Vault NFTs are an innovation that reduces transaction costs associated with the trade of physical goods, which can be beneficial to consumers interested in trading sneakers and other collectibles.

### A. Technologies and features that facilitate the trade of physical objects

53. Marketplaces, firms, and institutions in different historical contexts and using different types of technologies, have reduced the frictions that make trading physical objects difficult. More recently, various firms have worked on using the blockchain to achieve that goal.

#### 1. Untethering ownership from physical possession of assets

54. Untethering ownership from physical possession of assets to reduce transaction costs has been a primary motivation behind financial and monetary innovation. For instance, the introduction of paper money removed the burden and risks of transporting heavy gold and silver coinage for individuals, ultimately creating a more convenient means of payment. The creation of check clearinghouses and a national checking network in the late nineteenth century reduced transaction costs for banks, as they no longer needed to send daily messengers to every other

local bank to clear checks. Those lower transaction costs allowed checks from increasingly distant banks to be honored locally.<sup>118</sup>

55. Innovations in commodity markets were similarly designed to reduce trading frictions by untethering the act of trading from taking possession of physical objects. Grain traders in early nineteenth-century Chicago faced substantial storage and transportation costs every time they traded a shipment of grain, as the grain needed to be moved between silos each time.<sup>119</sup> In the late nineteenth century, the invention of futures contracts, which stipulated the delivery of a commodity on a certain date at a certain price, reduced the number of physical transactions to one. Grain traders could buy and sell the futures contracts as many times as desired in the interim without the grain physically changing hands.

56. More recently, blockchain technology and tokenization have been used to enable the trade of ownership rights without the need to physically transfer the underlying items. A blockchain is a digital database or ledger that stores transactional data across a network of computers in a distributed and decentralized fashion.<sup>120</sup> An emerging application of blockchain technology is asset tokenization, a process in which rights to tangible assets, which may be physical or digital, are converted into tradeable tokens, which can be traded digitally.<sup>121</sup> In this way, tokenization makes the trade of tangible assets more efficient, especially for relatively

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<sup>118</sup> David Evans and Richard Schmalensee, *Paying with Plastic: The Digital Revolution in Buying and Borrowing* 2 Ed., Cambridge, MA, The MIT Press, 2005, p. 41 (“Local banks received an increasing volume of out-of-town checks from merchants. The problem wasn’t just how to present that check—in person or by mail. Checks drawn on distant banks were more likely to bounce: it was harder to know whether any particular check was legitimate, ore difficult to collect from travelers, and harder for the law to catch a bad-check artist on the move. Hence, an out-of-town check wasn’t worth as much as one drawn on a local bank.”).

<sup>119</sup> Joseph Santos, “A History of Futures Trading in the United States,” <https://eh.net/encyclopedia/a-history-of-futures-trading-in-the-united-states/> (“By the 1840s, grain elevators and railroads facilitated high volume grain storage and shipment, respectively. Consequently, country merchants and their Chicago counterparts required greater financing in order to store and ship this higher volume of grain.”).

<sup>120</sup> McKinsey & Company, “What is blockchain?,” December 5, 2022, <https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-blockchain/> (“Blockchain is a technology that enables the secure sharing of information. Data, obviously, is stored in a database. Transactions are recorded in an account book called a ledger. A blockchain is a type of *distributed* database or ledger – one of today’s top tech trends – which means the power to update a blockchain is distributed between the nodes, or participants, of a public or private computer network.”).

<sup>121</sup> LeewayHertz, “Asset Tokenization – Real Assets on the Blockchain,” <https://www.leewayhertz.com/what-is-asset-tokenization/> (“Asset tokenization refers to the process of converting real assets into digital assets.”).

illiquid asset classes such as art, luxury items, real estate, or even commodities.<sup>122</sup> The tokens can be fungible—for instance, a token granting fractional ownership of a parcel of land, as it is interchangeable with another token or set of tokens granting the same share of ownership. They can also be non-fungible. NFTs represent ownership of unique items and are non-fungible in that they cannot be replaced.<sup>123</sup> For instance, a token linked to a specific piece of art is an NFT.

*2. Technologies and services to reduce information costs through reduced verification costs*

57. Many institutions and firms have put in place technologies to reduce information costs through reduced verification costs, which has been beneficial for trade. For example, the Gemological Institute of America (GIA), founded in 1931, has played a critical role in facilitating the trade of diamonds by making information more transparent and cheaper to obtain for diamond buyers and sellers. In 1953, the GIA created a grading standard called the 4Cs, and started issuing diamond grading reports. The grading standard has become a universal standard and the diamond grading reports are now a benchmark in the jewelry industry, assessing their quality with respect to color, clarity, cut, and carat weight.<sup>124</sup> In the 1980s, technology was developed to laser inscribe diamonds, allowing GIA to link the unique number of a diamond’s grading report to the stone through laser engraving, forever linking the stone to its one-time

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<sup>122</sup> Investopedia, “Non-Fungible Token (NFT): What it Means and How it Works,” April 6, 2023, <https://www.investopedia.com/non-fungible-tokens-nft-5115211> (“Tokenizing these real-world tangible assets makes buying, selling, and trading them more efficient while reducing the probability of fraud.”); LeewayHertz, “Asset Tokenization – Real Assets on the Blockchain,” <https://www.leewayhertz.com/what-is-asset-tokenization>, (“From exotic assets like artwork, sports teams and racehorses to traditional assets like bonds, real estate, venture capital funds, and commodities, almost every asset class can be tokenized.”).

<sup>123</sup> Kirk Plangger, Dhruv Grewal, Ko De Ruyter, and Catherine Tucker, “The Future of Digital Technologies in Marketing: A conceptual Framework and an Overview,” *Journal of the Academy of Marketing Science*, Vol. 50, No. 6, 2022, pp. 1125-1134, p. 1130 (“[N]on-fungible tokens (NFTs) allow for a range of digital products to come to market, secured by blockchain ledgers that establish them as original and unique.”); Business Insider, “What to Know About Non-Fungible Tokens (NFTs),” July 12, 2022, <https://www.businessinsider.com/personal-finance/nft-meaning> (“A non-fungible token (NFT) is a unique digital asset that represents ownership of real-world items like art, video clips, music, and more. NFTs use the same blockchain technology that powers cryptocurrencies, but they’re not a currency.”).

<sup>124</sup> Gemological Institute of America, “What is a GIA Diamond?,” <https://4cs.gia.edu/en-us/blog/what-is-a-gia-diamond>; Gemological Institute of America, “About GIA,” <https://www.gia.edu/gia-about>.

quality assessment.<sup>125</sup> This technology further reduced information costs, by reducing the need for future authentication.

58. Similarly, CARFAX’s vehicle history reports help reduce information costs in the market for used cars by providing buyers with information such as the car’s service history and potential accidents. This service simplifies the process for potential buyers to ascertain the quality of the car they are interested in, enabling them to “avoid buying a car with costly hidden problems.”<sup>126</sup> Such services help sales to take place, even when the buyer does not know the specific seller or how trustworthy they are.

59. Blockchain technology, and associated innovations like NFTs, have also been used to reduce information costs. What distinguishes blockchain from other databases is that the data stored on a blockchain is functionally immutable. In other words, no party can retroactively alter data associated with a transaction once that transaction has been added to the blockchain.<sup>127</sup> This feature has the potential to transform trade on digital marketplaces, as it provides a tool to verify and maintain records of transactions that does not rely on a third party or central authority. Such a decentralized mechanism both lowers the costs for marketplaces to verify digital information and increases the trust in the reliability of this information.<sup>128</sup> Therefore, from an

<sup>125</sup> Gemological Science International, “Laser Inscription on Diamonds,” <https://gemscience.net/services-and-reports/lab-services/laser-inscription-on-diamonds> (“By 1980, a major gemological laboratory in the United States successfully implemented the laser inscription process, and it was the first commercial application of diamond marking. The process was complex and required a lot of time and special equipment, but its commercial success showed that there is a definite need for marking on diamonds.”); Diamond Buzz, “Diamond Laser Inscription,” December 20, 2022, <https://diamondbuzz.blog/diamond-laser-inscription> (“Diamond laser inscription, provided by a grading laboratory, ensures that the stone you buy matches the issued grading report or certificate. It allows an instant verification that the stone is the one described in the report as the number or wording is permanently registered in the lab’s archive database. In other words, an inscription gives added security and peace of mind when making a diamond purchase. It is also helpful to jewellers [sic] and diamond merchants for quality control.”).

<sup>126</sup> Carfax, “Carfax Vehicle History Reports,” <https://www.carfax.com/vehicle-history-reports>.

<sup>127</sup> Catherine Tucker and Christian Catalini, “What Blockchain Can’t Do,” Cambridge, MA, Harvard Business Review, 2019, p. 61 (“Blockchain technology has the potential to do amazing things. It can provide an immutable, digital audit trail of transactions and can be used to cheaply verify the integrity of data.”).

<sup>128</sup> Catherine Tucker and Christian Catalini, “What Blockchain Can’t Do,” Cambridge, MA, Harvard Business Review, 2019, p. 62 (“[Blockchain] can therefore replace the need for trust between players, or the need for a central authority to verify and maintain the records of transactions.”); Christian Catalini and Catherine Tucker, “Antitrust and Costless Verification: an Optimist and a Pessimistic View of the Implications of Blockchain Technology,” *Antitrust Law Journal*, Vol. 82, No. 3, 2019, pp. 861-872, p. 1 (“Blockchain technology, by allowing economic agents to verify transactions and their attributes without the same need for trust or third-party verification, fundamentally changes how marketplaces operate. This is particularly relevant for digital

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economist’s perspective, the value of blockchain technology lies in the creation of permissionless and automated trust.<sup>129</sup> One example of the use of this technology is high-end watch brand Breitling, which sells each watch with a corresponding NFT that serves as proof of ownership and authenticity.<sup>130</sup> This technology has been perceived as having the potential to replace official papers that denote ownership, which are often necessary for owners selling watches on the secondary market.<sup>131</sup>

### 3. *Storage solutions such as vaults*

60. Vault-like storage solutions for collectibles have also been used to make it cheaper to trade physical items. Goldin and CardTrader are two examples of firms offering storage solutions to customers, which serve to reduce transaction costs. Goldin is a digital marketplace and auction-house for sports memorabilia, including game-worn jerseys, autographed sportswear, and vintage sports cards. Similar to StockX, Goldin allows collectors to store items bought through them in a physical vault. Collectors do not need to pay sales tax, shipping fees, or storage fees for items they choose to store in the Vault, which considerably reduces transaction fees for buyers and sellers.<sup>132</sup> Goldin is currently facilitating peer-to-peer

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marketplaces. Blockchain technology lowers the cost of verifying digital information but does not lower the cost of verifying offline information.”).

<sup>129</sup> Christian Catalini and Catherine Tucker, “Antitrust and Costless Verification: an Optimist and a Pessimistic View of the Implications of Blockchain Technology,” *Antitrust Law Journal*, Vol. 82, No. 3, 2019, pp. 861-872, pp. 2-3 (“Blockchain technology takes advantage of cryptography and incentives to replace trust and third-party verification. … Incentives are needed to protect the shared data from being altered by an adversary or bad actor, and to ensure that transactions or assets cannot be forged or modified *ex post*. For example, in implementations that rely on proof-of-work (‘mining’), an economic cost is introduced to make it prohibitively expensive to rewrite history and subvert the consensus about the true state of the shared data once it is formed.”).

<sup>130</sup> Crypto News, “NFTs and Their Role in the Luxury Watch Industry,” February 10, 2023, <https://cryptonews.com/news/nfts-their-role-luxury-watch-industry.htm> (“Breitling, a well-respected manufacturer with a history stretching back as far as 1884, has harnessed the power of the metaverse in an entirely different way. Since October 2020, all Breitling watches have come with their own NFT (or digital passport, as the company calls them) as proof of ownership and authenticity.”).

<sup>131</sup> Crypto News, “NFTs and Their Role in the Luxury Watch Industry,” February 10, 2023, <https://cryptonews.com/news/nfts-their-role-luxury-watch-industry.htm> (“It has been speculated that such [NFT] technology will soon replace the original papers that accompany a luxury watch when bought from an official retailer. These documents are often vital on the secondary market, playing a huge role in resale value and in ensuring potential buyers that the seller is the timepiece’s rightful owner.”).

<sup>132</sup> Goldin, “The Official Vault of Goldin,” <https://goldin.co/vault> (“Pay no sales tax, storage, or shipping fees on Goldin purchases sent to the Vault. Plus your items are 100% insured.”).

transfers of ownership for items stored in its vault and has expressed an intention to add greater marketplace functionality to its website.<sup>133</sup>

61. CardTrader, discussed in Section V, also offers a storage solution for its users, the CTZero service. Buyers who enroll in the service can purchase cards from multiple sellers around the world and choose to have them stored centrally in CardTrader’s warehouse “with no limits on time or quantities.”<sup>134</sup> Buyers are responsible for only a single shipping fee when they are ready to retrieve their cards, which does not depend on the number of cards or their original geographic provenance.<sup>135</sup> Sellers also save on shipping costs, as the service allows them to ship sold cards to the CardTrader warehouse in bulk rather than ship the cards to individual buyers.

## B. Vault NFTs reduce trading costs for sneaker traders

### 1. *Sneaker traders are a key group of StockX’s users*

62. As explained in Section IV.B, StockX and similar resale platforms have increased both overall interest and participation in the resale sneaker market. One of the groups that has particularly benefited from the emergence of StockX and similar resale platforms are sneaker traders. Traders are typically individuals who see rare sneakers as opportunities for arbitrage and are primarily interested in purchasing sneakers to resell them at a profit.

63. StockX, especially in comparison to rival resale platforms, has developed a platform that appeals to sneaker traders looking to buy and later resell sneakers. The original impetus for launching StockX—as suggested by its name—was to create a “stock market of

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<sup>133</sup> Goldin, “Frequently Asked Questions,” <https://vault.goldin.co/faqs> (“If you would like to sell an item that you have stored in the vault, you have several options. You can consign it for sale in one of our upcoming auctions by emailing your consignment director or info@goldinauctions.com or we can help you find a buyer through a private sale by emailing info@goldinauctions.com. We are currently facilitating peer-to-peer title transfers and will offer additional marketplace functionality on our site later this year. If you would like a title transfer, email vault@goldinauctions.com.”).

<sup>134</sup> CardTrader, “CardTrader Zero,” <https://www.cardtrader.com/pages/zero>.

<sup>135</sup> CardTrader, “CardTrader Zero,” <https://www.cardtrader.com/pages/zero> (“You can request that we ship your purchases at any time. You will pay a single shipping fee, no matter where the sellers you bought from are located or how many they are.”).

things” in which the value of sneakers and apparel was transparent and updated in real time.<sup>136</sup> StockX has successfully integrated this original vision into the current platform where, as detailed in Section V.B.2, users have access to a wide range of data for every item sold on StockX.<sup>137</sup> Such extensive pricing data is useful not only for collectors looking for a good deal on StockX, but also for sellers throughout the resale market, who turn to StockX to determine the market price for their items.<sup>138</sup> StockX has been nicknamed the Kelley Blue Book of sneakers,<sup>139</sup> a reference to the established automotive research company providing vehicle valuation services.<sup>140</sup>

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<sup>136</sup> Jacob Gallagher, “This Website is the Stock Market for Nikes and Rolexes,” *The Wall Street Journal*, November 26, 2018, <https://www.wsj.com/articles/this-website-is-the-stock-market-for-nikes-and-rolexes-1543251772> (“Mr. Luber envisioned a more orderly market, with a New York Stock Exchange-style ticker, that would make the value of a pair of sneakers transparent, in real time.”) and (“Mr. Gilbert bought Campless in 2015 and the pair joined forces (along with COO Greg Schwartz), launching StockX, “the stock market of things,” based in Mr. Gilbert’s hometown of Detroit in February 2016.”).

<sup>137</sup> Dan Hyman, “A Nasdaq for Sneakerheads? StockX Aims to Tame ‘Chaos’ of Luxury Market,” *The New York Times*, July 6, 2018, <https://www.nytimes.com/2018/07/06/business/smallbusiness/stockx-sneakerheads-luxury-goods.html> (“On StockX, products, which include streetwear, handbags and watches in addition to sneakers, are assigned ticker symbols. Sellers put out asking prices, and buyers bid. Users can see data like recent sale figures from across the internet, price volatility, and 52-week highs and lows. Once a bid and an ask coincide, the sale is automatically made.”).

<sup>138</sup> Jacob Gallagher, “This Website is the Stock Market for Nikes and Rolexes,” *The Wall Street Journal*, November 26, 2018, <https://www.wsj.com/articles/this-website-is-the-stock-market-for-nikes-and-rolexes-1543251772> (A sneaker seller interviewed for the article claimed, “everyone looks at StockX and takes it as the market price”); Jessica Testa, “Sneaker Sellers Wrestle With Price Spikes After Virgil Abloh’s Death,” *The New York Times*, December 16, 2021, <https://www.nytimes.com/2021/12/16/style/sneakers-price-spikes-virgil-abloh.html> (The owner of a resale sneaker store in Seattle asserted that “when people come in now to sell shoes, we look at StockX as the price reference, and we’ve upped our offers to reflect the market.”).

<sup>139</sup> Wells Report, ¶ 110 (“StockX is also valuable for many Sneakerheads because it provides detailed and otherwise difficult to obtain information like the sale history and average sale price for every model of sneaker. This data is not only useful for consumers looking for a good deal, but also helps set prices in the resale market, since resellers often reference StockX to determine a fair price for their items. In this regard, StockX has been described to be for the sneaker market what the Kelley Blue Book is for the car market.”); Polina Noskova, “This Sneakerhead Made a Stock Exchange for Shoes,” *Forbes*, August 18, 2016, <https://www.bloomberg.com/news/articles/2016-08-18/this-sneakerhead-made-a-stock-exchange-for-shoes> (“[Josh Luber, the founder of StockX,] collected eBay’s pricing data and built the kind of guide for sneakers that Kelley Blue Book compiles for automobiles.”).

<sup>140</sup> Kelley Blue Book, “History,” <https://www.kbb.com/company/history> (“We deliver up-to-date car values, expert reviews and unbiased reporting at no cost to you.”).

## 2. *Vault NFTs*

64. StockX created Vault NFTs as an innovative way to provide users of its platform with a “new, faster, cheaper and more efficient trading experience.”<sup>141</sup> By issuing Vault NFTs, StockX untethers ownership from physical possession of products and enables its users to trade ownership rights without physical products ever needing to be relocated.<sup>142</sup> As explained by StockX on its website, Vault NFTs allow customers to buy and resell products almost immediately, bypassing physical trade and its associated costs, both in terms of money and time.<sup>143</sup> In addition, each Vault NFT is linked to a specific authenticated physical product, which is stored in StockX’s secure, climate-controlled facility and depicted on the NFT.<sup>144</sup> This feature reduces both information costs—bypassing the need for re-verification—and costs related to storage logistics and safety. As a result, Vault NFTs reduce various types of frictions associated with the trade of physical products.

[REDACTED]

[REDACTED]

[REDACTED]

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## 3. *Vault NFTs reduce trading costs, including by eliminating the costs of shipping and re-verification*

65. Trading Vault NFTs, rather than physical products, reduces the transaction and information costs incurred while trading on StockX. In particular, buyers and sellers will save on

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<sup>141</sup> StockX, “NFTs,” <https://stockx.com/lp/nfts>.

<sup>142</sup> StockX, “NFTs,” <https://stockx.com/lp/nfts> (“Introducing Vault NFTs on StockX, new digital tokens providing unprecedented access and utility for our customers. Each Vault NFT is tied to a physical product (as depicted on the NFT), which is stored in our brand new, climate-controlled, high-security vault.”).

<sup>143</sup> StockX, “NFTs,” <https://stockx.com/lp/nfts> (“Because each Vault NFT is tied to a physical product already stored in the StockX vault, you no longer have to wait several days before you can resell, and you do not have to pay fees associated with multiple legs of shipping and authentication.”); StockX, “StockX Launches Vault NFTs,” January 18, 2022, <https://stockx.com/about/stockx-launches-vault-nfts> (“Vault NFTs are minted under custodial authority as ERC-1155 tokens on the Ethereum blockchain to reduce transaction fees, minimize environmental impacts, and create provenance.”).

<sup>144</sup> StockX, “NFTs,” <https://stockx.com/lp/nfts> (“Each Vault NFT is tied to a physical product (as depicted on the NFT), which is stored in our brand new, climate-controlled, high-security vault.”).

<sup>145</sup> [REDACTED]

[REDACTED]

[REDACTED]

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shipping fees and time, as the product underlying a Vault NFT does not have to physically change hands.

[REDACTED]

[REDACTED]

[REDACTED]

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[REDACTED]<sup>147</sup> Another benefit associated with Vault NFTs is that the verification process for the underlying product must happen only once, not every single time the asset is traded. Because the physical products tied to the Vault NFTs are stored in a secure and central location, they need not be verified each time the Vault NFTs are traded. As a result, trading costs are reduced.

66. To illustrate these savings, Exhibit 2 compares the fees incurred by sellers and buyers when trading a physical pair of sneakers on StockX with the fees incurred for trading a Vault NFT of the same total price—here, \$225.

67. The buyer of a physical pair of shoes on StockX pays shipping, product verification, and payment processing fees, which are proportional to the value of the shoes.<sup>148</sup> The seller of physical sneakers on StockX has to pay an 8 to 10% transaction fee, a 3% payment processing fee, and a shipping fee that depends on a number of factors.<sup>149</sup> For the trade of a

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[REDACTED]

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[REDACTED].

<sup>148</sup> StockX, “How much does shipping cost for Buyers?,” July 22, 2022, <https://stockx.com/help/articles/How-much-does-shipping-cost-for-buyers> (“Shipping fees vary based on a variety of factors including the price of the item, size of the item, item type, shipping costs determined by our carrier partners, and the shipping destination of the Buyer.”); StockX, “What are StockX’s fees for Buyers?,” August 3, 2022, <https://stockx.com/help/en-GB/articles/What-are-StockXs-fees-for-buyers> (“As a Buyer on StockX, you are responsible for paying processing fees, as well as any customs duties and sales tax based on your shipping address.”).

<sup>149</sup> StockX, “How much does shipping cost for sellers?,” December 30, 2022, <https://stockx.com/help/en-GB/articles/How-much-does-shipping-cost-for-Sellers> (“Shipping fees vary according to several factors including the price of the item, size of the item, item type, shipping costs determined by our carrier partners, and the Seller’s location.”); StockX, “What are StockX’s fees for Sellers?,” March 27, 2023,

physical pair of shoes worth a total of \$225, buyer and seller jointly pay almost \$60 in total fees associated with the trade.

68. By contrast, trading a Vault NFT on StockX entails much lower fees. First, it does not involve any shipping fees for both buyer and seller and processing fees for the buyer.<sup>150</sup> The transaction and payment processing fees paid by the seller are about two-thirds lower, at 3% and 1% compared to 8-10% and 3%.<sup>151</sup> The total transaction fees associated with the trade of a Vault NFT are a small fraction—around 16%—of the total transaction fees associated with the trade of the physical pair of sneakers, at \$9 compared to \$57.25.<sup>152</sup>

**Exhibit 2: Exemplar Comparison of Transaction Costs Associated with the Trade of a \$225 Physical Pair of Shoes and a \$225 Vault NFT on StockX<sup>153</sup>**

Cost Items	Physical Pair	Vault NFT
<i>Buyer</i>		
Shipping fee	\$15.00	-
Processing and verification service fee <sup>[1]</sup>	\$13.50	-
<i>Seller</i>		
Shipping fee within the US	\$ 4.00	-
Payment processing fee <sup>[2]</sup>	\$ 6.75	\$ 2.25
Transaction fee <sup>[3]</sup>	\$18.00	\$ 6.75
<b>Total</b>	<b>\$57.25</b>	<b>\$ 9.00</b>

**Notes:**

[1] Processing and verification fees may vary, as they are determined by the price of the item, the

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<https://stockx.com/help/articles/What-are-StockXs-fees-for-sellers> (“For all StockX sales there is a 3% payment processing fee, as well as a transaction fee that is determined by your Seller Level in accordance with the StockX Seller Program”).

<sup>150</sup> StockX, “What fees are associated with Vault NFTs?,” April 14, 2022, <https://stockx.com/help/articles/What-fees-are-associated-with-Vault-NFTs> (“When purchasing an NFT, customers are not subject to StockX processing or shipping fees nor sales tax.”).

<sup>151</sup> StockX, “What fees are associated with Vault NFTs?,” April 14, 2022, <https://stockx.com/help/articles/What-fees-are-associated-with-Vault-NFTs> (“When selling an NFT, customers are subject to a 3% transaction fee plus a 1% payment processing fee.”).

<sup>152</sup>  $\$9 / \$57.25 * 100\% = 15.7\%$ .

<sup>153</sup> Tidal Market, “How Much is StockX Shipping?,” February 6, 2023, [www.tidalmarket.com/blog/how-much-is-stockx-shipping](http://www.tidalmarket.com/blog/how-much-is-stockx-shipping) (“Shipping fees are different depending on the price, weight, and category the item is in. For the most part, all shoes and electronics will be around \$15.”); StockX, “What are StockX’s fees for Buyers?,” August 3, 2022, <https://stockx.com/help/en-GB/articles/What-are-StockXs-fees-for-buyers> (“As a Buyer on StockX, you are responsible for paying processing fees, as well as any customs duties and sales tax based on your shipping address. There is no set percentage for fees, as these are determined by the price of the item, the

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location of the Seller and Buyer, and supply and demand. To estimate typical processing and verification fees, I limit the physical data to sneakers with a gross monetary value of \$225, divide the buyer fee for each relevant transaction by \$225, then take the average of these ratios. The resulting average is 6% ( $6\% * \$225 = \$13.50$ ).

[2] For a physical pair of shoes, the payment processing fee is 3% ( $3\% * \$225 = \$6.75$ ). For a Vault NFT on StockX, the payment processing fee is 1% ( $1\% * \$225 = \$2.25$ ).

[3] For a physical pair of shoes, I assume an 8% transaction fee because this represents the lower end of the possible 8-10% range advertised on the StockX website ( $8\% * \$225 = \$18.00$ ). For a Vault NFT on StockX, the transaction fee is 3% ( $3\% * \$225 = \$6.75$ ).

69. Vault NFTs may also lower trading costs in other ways. For example, Vault NFTs can be traded more quickly than physical items, as any delays related to shipping and verification are eliminated.

70. In addition, StockX’s storage services provide the potential for a less costly and more convenient option for owners to manage and safely store their collections. Sneaker collectors often keep digital records of their inventory in a spreadsheet—which records information such as the brand, model, colorway, and release date—and affix photos of shoes to their boxes to facilitate identification and retrieval from a dedicated storage space at home.<sup>154</sup> Owners of especially large inventories often rent separate storage facilities, which may lack the appropriate safeguards against theft.<sup>155</sup> Vault NFTs allow their owners to delegate all storage-

location of the Seller and Buyer, and supply and demand. These will never change after you have placed a Bid.”); StockX, “Physical Data,” STX0806026; StockX, “How much does shipping cost for sellers?,” December 30, 2022, <https://stockx.com/help/en-GB/articles/How-much-does-shipping-cost-for-Sellers> (showing US Shipping Costs of \$4.00); StockX, “What are StockX’s fees for Sellers?,” March 27, 2023, <https://stockx.com/help/articles/What-are-StockXs-fees-for-sellers> (“For all StockX sales there is a 3% payment processing fee, as well as a transaction fee that is determined by your Seller Level in accordance with the StockX Seller Program,” which ranges from 8.0% to 10.0%, depending on the sales requirement, if any.); StockX, “What fees are associated with Vault NFTs?,” April 14, 2022, <https://stockx.com/help/articles/What-fees-are-associated-with-Vault-NFTs> (“When purchasing an NFT, customers are not subject to StockX processing or shipping fees nor sales tax. When selling an NFT, customers are subject to a 3% transaction fee plus a 1% payment processing fee.”).

<sup>154</sup> Wells Report, ¶113 (“Many Sneakerheads use methods like taking photos of the sneakers and putting the photos on the outside of the box. This helps them quickly identify which sneakers are in which box and can save time when searching for a specific pair. They often keep a detailed inventory of their collection in a Google Doc, including information about each sneaker like the brand, model, colorway, and the release date, to keep track of their collection.”).

<sup>155</sup> WPCO, “Cincinnati Business Owner Out \$100,000 After Thieves Steal Hundreds of Sneakers From Storage Unit,” April 8, 2022, <https://www.wcpo.com/news/local-news/hamilton-county/cincinnati/avondale/cincinnati-business-owner-out-100-000-after-thieves-steal-hundreds-of-sneakers-from-storage-unit> (“[The victim] said his 300 sneakers were safe at CubeSmart Self Storage in Avondale. When he returned, though, everything was gone. ‘Probably about an estimated value of \$100,000 dollars.’”); Sneaker Shop Talk, “Stupid things People do for Sneakers: Thieves Steal Hundreds of Kicks From Business Owner’s Storage Locker,” June 3, 2022, <https://sneakershop talk.com/stupid-things-people-do-for-sneakers-thieves-steal-hundreds-of-kicks-from>

related logistics to StockX, which safely stores the underlying physical product in a climate-controlled, high-security vault and provides an online interface for owners to quickly view the contents of their collection.

### C. Other examples of innovative uses of physical NFTs and storage solutions

71. Other examples of innovations featuring physical NFTs<sup>156</sup> accompanied by storage solutions can be found in the fine liquor, fine wine, and luxury watch industries. For instance, BlockBar is a platform that sells Ethereum blockchain-based NFTs associated with physical bottles of liquor, including bottles from luxury brands, such as Patrón and Rémy Martin.<sup>157</sup> Like StockX, BlockBar provides authentication<sup>158</sup> and storage services<sup>159</sup> for bottles sold on the platform, and users have the option to trade their NFTs on the BlockBar marketplace or redeem them in exchange for the physical bottle. BlockBar recently recruited Sotheby’s Worldwide Chairman of Wine and Spirits to serve as its Chief Operating Officer.<sup>160</sup>

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business-owners-storage-locker (“A Southwest Miami-Dade area storage facility found itself the victim of a burglary, with multiple units being hit, including one ... containing hundreds of pairs of expensive sneakers.”); 10 News San Diego, “More than \$100,000 Worth of Sneakers Stolen in Mission Valley Storage Theft,” July 16, 2021, <https://www.10news.com/news/local-news/more-than-100-000-worth-of-sneakers-stolen-in-mission-valley-storage-theft> (“[A] thief emptied out his rented storage locker, stealing more than \$100,000 in sneakers.”).

<sup>156</sup> CoinGape, “Explained: What is Physical NFT? And How to Sell Physical Items as NFT,” December 28, 2022, <https://coingape.com/education/explained-what-is-physical-nft-and-how-to-sell-physical-items-as-nft> (“Physical NFTs are cryptographic tokens linked to physical assets that provide ownership of artwork, merchandise, property deeds, and other assets. Physical NFTs have two parts where the digital one is stored on a blockchain, and the physical one is the one that you own in real life.”).

<sup>157</sup> BlockBar, “BlockBar,” <https://blockbar.com> (“BlockBar is a platform that offers NFTs (digital assets) directly from luxury liquor brands. Each NFT corresponds to a physical bottle. Consumers have the ability to exchange the digital version for the physical version. In simple terms, consumers own the physical bottle, BlockBar stores it for them, and the digital version serves as proof of authenticity, verification of ownership, and the right to have the physical bottle delivered.”).

<sup>158</sup> BlockBar, “BlockBar,” <https://blockbar.com> (“BlockBar proves authenticity via Ethereum’s blockchain. By buying the NFT directly from the brand, we not only make the process easier, but we ensure that your asset has proven authenticity. Whether you grow your collection, send it as a gift, or resell it, authenticity will never be an issue. BlockBar ensures 100% instant authenticity to all collectors up until the moment they redeem the bottle.”).

<sup>159</sup> BlockBar, “How it Works,” <https://blockbar.com/how-it-works> (“As the NFTs are minted, the brands ship the bottles to BlockBar’s secure warehouse in Singapore. This warehouse is bonded, temperature controlled and insured. Storing your own spirits is extremely difficult and expensive so BlockBar takes care of this for you.”).

<sup>160</sup> Medium, “Sotheby’s Worldwide Chairman of Wine and Spirits to Join BlockBar,” <https://medium.com/@blockbar/sotebys-worldwide-chairman-of-wine-and-spirits-to-join-blockbar->

72. Like liquor, wine can be an attractive and valuable asset, but is difficult to trade due to significant transportation and storage costs. There are also unique concerns about verifying provenance when it comes to investing in fine wine.<sup>161</sup> To address these inefficiencies, WiV Technologies verifies and stores crates of wine at a central facility, and then issues easily tradable tokens to owners, which are linked to the physical crates of wine.<sup>162</sup>

73. In the luxury watch industry, much like StockX, VeblenVault sells physical NFTs for a variety of luxury-brand watches and stores the underlying time pieces in “secure and insured vaults.”<sup>163</sup> As noted on the company’s website, “Veblen Vault NFTs capture the price movements of physical assets without assuming the risks of secure storage, damage, theft and appropriation.”<sup>164</sup> The online platform WatchBox is pursuing a similar venture, including both physical NFTs and storage services.<sup>165</sup>

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e39b296dd5db (“Jamie Ritchie to become Chief Operating Officer of BlockBar, the startup that is democratizing the world of wine and spirits through their unique blockchain based business model.”).

<sup>161</sup> EY, “EY Helps WiV Technology Accelerate Fine Wine Investing With Blockchain,” August 12, 2019, [https://www.ey.com/en\\_gl/news/2019/08/ey-helps-wiv-technology-accelerate-fine-wine-investing-with-blockchain](https://www.ey.com/en_gl/news/2019/08/ey-helps-wiv-technology-accelerate-fine-wine-investing-with-blockchain) (The CEO of WiV says that “[f]ine wine is a fully tradeable asset, and it is vitally important that provenance is protected, because provenance is the only way to prove a wine’s true value without actually opening the bottle. Currently, many wine trades often slow to a crawl because the extensive paper trails must be manually checked at every step of the process, massively reducing the potential size of the market. We are enhancing the ecosystem so that fine wine investments can be traded as quickly, easily and safely as books are online. We want to make fine wine an asset that people invest in with confidence.”).

<sup>162</sup> WiV, “The First Company Bringing Physical to Digital as NFTs,” <https://wiv.io> (“At WiV we have developed a proprietary technology solution that allows us to verify, secure authenticity and provenance of physical real world assets (pRWA), starting with wine, by combining IoT and blockchain technology... By authenticating these physical assets (PRWA) and pairing them with a digital counterpart, we allow anyone who owns a WiV asset to trade it with anyone else in the world without the hassle of holding the pRWA or having to worry about fraud and counterfeiting.”); The WiV Company, WiVA - The Future of Wine, 2022, ([audio] at 0:15-0:23 “The wine itself is housed in professionally managed cellars to ensure that it is maintained in top condition and that its provenance is assured”).

<sup>163</sup> Veblen Vault, “About Us,” <https://veblenvault.com/about-us> (“Together, we have created a new way to enjoy collecting and trading watches by storing high end timepieces in secure and insured vaults and tokenizing the ownership on the Ethereum blockchain.”).

<sup>164</sup> Veblen Vault, “Veblen Vault,” <https://veblenvault.com>.

<sup>165</sup> WatchPro, “WatchBox Creates Tradeable NFT Avatars of Luxury Watches,” April 28, 2022, <https://www.watchpro.com/watchbox-creates-tradeable-nft-avatars-of-luxury-watches> (“Origyn and WatchBox will produce Utility NFTs for watches, which can be traded independently from the physical items. ... It means Watchbox could create and sell the NFT of a watch that remains in its safe and under its security. The owner of that unique NFT (and the watch to which it is attached) could then be traded at any point in the future — instantly like selling shares, and safely because it would be a legally binding trade. These NFTs also tackle the issue of counterfeit watches by acting as blockchain-based certificates of authenticity for luxury watches purchased on WatchBox’s platform.”).

## VII. THE EVOLUTION OF VAULT NFT PRICES LINKED TO NIKE SHOES

74. In its amended complaint, Nike claims that “StockX has sold Nike-branded Vault NFTs at prices many multiples above the price of the physical Nike shoe”<sup>166</sup> and that “significant price discrepancies continue, and as of the [then] current date [May 2022] certain Nike-branded Vault NFTs [were] still selling for thousands of dollars above the price of the physical shoe.”<sup>167</sup> This section provides a description of how the price of Vault NFTs for Nike shoes evolved in 2022, and explains how those dynamics are consistent with the pricing patterns of both historical and more recent examples of assets linked to new technologies.

### A. How the price of Vault NFTs for Nike shoes evolved in 2022

75. On January 18, 2022, StockX announced the release of Vault NFTs.<sup>168</sup> The first Vault NFTs that StockX released were for seven pairs of Nike sneakers and one pair of adidas sneakers. The Vault NFT of an eighth pair of Nike sneakers was also released on January 26, 2022. An overview of the Vault NFTs released by StockX linked to Nike sneakers, including the date of release, the number of Vault NFTs released, the number of peer-to-peer transactions, and the initial release price by StockX, is shown in Exhibit 3. As Nike sued StockX on February 3, 2022, StockX only released those eight Vault NFTs tied to Nike shoes. However, StockX continued releasing Vault NFTs for other brands, such as the Vault NFT Puma MB.01 LaMelo Ball Rick and Morty, which StockX released in March 2022 and which was traded 21 times,<sup>169</sup> and the Vault NFT Crocs Pollex Clog by Salehe Bembury Urchin, which StockX released in June 2022, and which was traded 31 times.<sup>170</sup>

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<sup>166</sup> First Amended Complaint, ¶ 63.

<sup>167</sup> First Amended Complaint, ¶ 65.

<sup>168</sup> StockX, “StockX Launches Vault NFTs,” January 18, 2022, <https://stockx.com/about/stockx-launches-vault-nfts>.

<sup>169</sup> StockX, “StockX Vault NFT Puma MB.01 LaMelo Ball Rick and Morty - US M 10,” <https://stockx.com/puma-mb01-lamelo-ball-rick-and-morty-vault-nft>.

<sup>170</sup> StockX, “StockX Vault NFT Crocs Pollex Clog by Salehe Bembury Urchin - US M 10,” <https://stockx.com/crocs-pollex-clog-by-salehe-bembury-urchin-vault-nft>.

**Exhibit 3: Summary Statistics of Vault NFTs Corresponding to Selected Nike Sneakers<sup>171</sup> (2022)**

Model of Corresponding Nike Shoe	First Release Date	Number of Released Vault NFTs	Number of P2P Transactions	Initial Release Price	Physical Price (on StockX)
Air Jordan 1 Retro High OG Bred Patent	1/26/2022	208	358	\$300	\$295
Air Jordan 4 Retro White Oreo 2021	1/18/2022	100	142	\$400	\$462
Nike Dunk Low Retro White Black 2021	1/18/2022	100	137	\$220	\$282
Nike Blazer Low sacai KAWS Blue	1/18/2022	100	127	\$120	\$165
Nike SB Dunk Low Ben Jerrys Chunky Dunky	1/18/2022	3	9	\$1,250	\$1,334
Nike Air VaporMax 2019 CPFM	1/18/2022	3	3	\$600	\$900
Air Jordan 3 Retro A Ma Maniere W	1/18/2022	1	2	\$450	\$721
Nike Dunk Low Off White Lot 50	1/18/2022	1	1	\$750	\$1,103
<b>Total</b>		<b>516</b>	<b>779</b>		

**Note:** The initial release price for Vault NFTs linked to the Air Jordan 1 sneakers is inferred based on their uniform price of \$300 sold by StockX on the first day of release. “Physical Price (on StockX)” is the average price for the associated physical sneaker on StockX on the first release date.

*1. The initial pricing of Vault NFTs*

76. StockX initially priced the Vault NFTs at a discount compared to the price of the physical pairs on the platform, expecting an initial loss at the time of the launch given that it had to procure the physical shoes at the current market price to store in the Vault. For instance, the Vault NFT for the Nike Dunk Low Retro White and Black was initially offered for \$220, when the lowest ask price for the physical shoe on StockX at the time was just above \$300, reflecting a 27% discount.<sup>172</sup> While the retail price on the Nike website was \$110, the shoe was sold out at the time the Vault NFTs were released.<sup>173</sup> [REDACTED]

<sup>171</sup> StockX, “Vault NFT Data,” STX0806025. See also StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216 (providing release prices).

<sup>172</sup> StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216.

<sup>173</sup> Sole Retriever, “Why Does the Nike Dunk Low Panda Keep Restocking?,” September 12, 2022, <https://www.soleretriever.com/news/articles/why-the-nike-dunk-low-panda-restocks-all-the-time-carryover-releases>, (“The next Nike Dunk Low Panda restock is set for April 28th, 2023 through the Nike App in full-family sizing. Alongside this, we will see the Nike Dunk High ‘Panda’ restock in full-family sizing.”).

<sup>174</sup> Calculated as the difference between the Vault NFT initial price and the lowest ask at the time, relative to the Vault NFT initial price, weighted by the number of Vault NFTs offered. See StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216.

reach a critical mass.<sup>175</sup> StockX generates revenues through fees charged on peer-to-peer Vault NFT trades, as illustrated in Exhibit 2.<sup>176</sup>

77. At the time, StockX’s CEO Scott Cutler said, when discussing Vault NFTs, that “optimally these should trade between our market price less fees.”<sup>177</sup> Shervin Moghaddam, StockX’s Vice President of Strategy, also expressed the idea that there should be an “equilibrium” between Vault NFTs and physical shoes.<sup>178</sup> Both views reflect that Vault NFTs were a new method of trading the physical shoes.

## 2. *The January 2022 spike*

78. On the first day of trading, the prices of the first Vault NFTs linked to Nike sneakers spiked. The average price of those Vault NFTs reached up to 7.2 times the prices of the corresponding physical pairs at the time for peer-to-peer sales.<sup>179</sup> On that day, a bug in the system prevented StockX from releasing all 308 Vault NFTs at the initial prices, which may have contributed to a sense of scarcity and price increases that were not intended by StockX’s launch pricing model.<sup>180</sup> StockX released the remaining 148 Vault NFTs at then-prevailing market

<sup>175</sup> Bruno Julien, Alessandro Pavan, and Marc Rysman, “Two-Sided Markets, Pricing, and Network Effects,” *Social Science Research Network*, 2021, pp. 1-100, p. 511 (“With introductory pricing, a firm subsidizes demand in one period and recovers the loss in future periods.”).

<sup>176</sup> StockX, “What fees are associated with Vault NFTs?,” April 14, 2022, <https://stockx.com/help/articles/What-fees-are-associated-with-Vault-NFTs> (“When selling an NFT, customers are subject to a 3% transaction fee plus a 1% payment processing fee.”).

<sup>177</sup> StockX, “Email From Shervin Moghaddam to Scutt Cutler and Yasir Malik,” January 20, 2022, STX0039795-801 at 795 (“What’s clear to me is that we need much more than 100 editions as optimally these should trade between our market price less fees. My guess is 10x daily volume in each sneaker at least in NFT.”).

<sup>178</sup> StockX, “Email From Shervin Moghaddam to Scutt Cutler and Yasir Malik,” January 20, 2022, STX0039795-801 at 795 (“That’s helpful guidance re: daily volume. Let us we [sic] on what those numbers would need to be. Ideally, this is all market driven - users submit to vault until prices between vault and physical stabilise and then the users maintain equilibrium between the two.”).

<sup>179</sup> This ratio is the average daily peer-to-peer trading price over the average daily physical price for Nike Blazer Low sacai KAWS Blue sneakers on January 18, 2022. See StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026.

<sup>180</sup> StockX, “Email From Yasir Malik to Greg Schwartz and Jacob Fenton,” January 19, 2022, STX0102190-195 at 193 (“We were on track to sell out in minutes but some bugs meant that we sold only 162 of the 309 NFTs we had available before our asks were tied up and secondary trading started.”); StockX, “Email From Shervin Moghaddam to Scutt Cutler and Yasir Malik,” January 20, 2022, STX0039795-801 at 795 (discussing Vault NFTs: “optimally these should trade between our market price less fees.”).

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prices<sup>181</sup> by filling open asks on the marketplace; at the time, these open asks were higher than the initial sale price, and about 2.8 times the price of their physical counterparts.<sup>182</sup>

79. StockX released the eighth Vault NFT linked to a Nike model, the Air Jordan 1 Retro High OG Patent Bred, on January 26, 2022, 8 days later, for \$300, slightly above the price of the physical shoes at the time.<sup>183</sup> First-day peer-to-peer prices averaged \$756, 2.6 times the level of the average physical shoes traded on that day on StockX.<sup>184</sup> Additional statistics on the released Vault NFTs associated with Nike sneakers, including the prices on the first day of release, are shown in Exhibit D1.

### *3. February to May 2022: The rapid convergence to the physical price*

80. The initial price spike that followed the introduction of the Vault NFTs gave way to a drop in both transactions and prices within a matter of weeks, when prices stabilized and converged to a level close to the price of physical shoes. For example, looking at two of StockX’s most traded Vault NFTs associated with Nike sneakers, the Nike Blazer Low sacai KAWS Neptune Blue and the Air Jordan 1 Retro High OG Patent Bred, Exhibits 4 and 5 show the average weekly price of the Vault NFT and of the physical shoes traded on StockX in 2022. The average weekly price dynamics of additional Vault NFTs linked to two other Nike sneaker models are presented in Appendix D. The charts differentiate the prices achieved through peer-to-peer trades of the Vault NFT, StockX’s initial release price of the Vault NFT, and the average

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<sup>181</sup> StockX, “Email From Shervin Moghaddam to Scutt Cutler and Yasir Malik,” January 20, 2022, STX0039795-801 at 795 (“No problem. Execute against the market...we are not here to preserve the price. Execute in 25 unit increments each half hour and be done in three hours.”).

<sup>182</sup> To obtain this number, I compute the ratio of the average price for Vault NFTs sold by StockX at market prices over the average physical price in January 2022 for each model. I then take the average of these ratios across models, weighted by the count of Vault NFTs sold by StockX at market prices. I exclude the price of Air Jordan 1 sneakers from this average because they were released separately. See StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026.

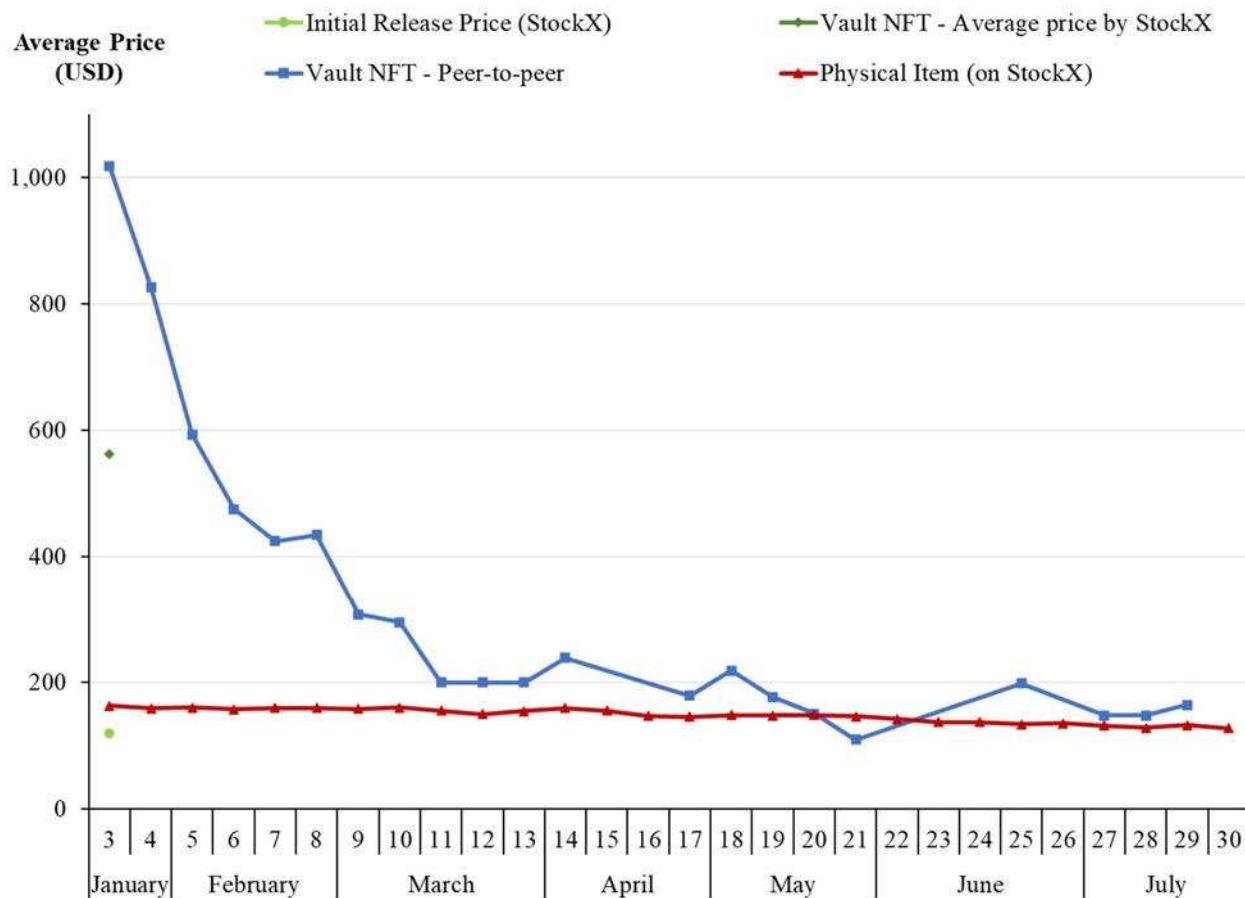
<sup>183</sup> The initial release price for Vault NFTs is inferred based on their uniform price of \$300 sold by StockX on the first day of release. The average price of physical Air Jordan 1 sneakers sold on the StockX website on January 26, 2022 is \$295. See StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026.

<sup>184</sup> \$756 is the average peer-to-peer price on January 26, 2022, the day that Air Jordan 1 Vault NFTs were first released.  $2.6 = \$756 / \$295$ , with \$295 corresponding to the average physical price on that day. See StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026.

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price that the Vault NFT was sold for by StockX. These latter prices differ for the Nike Blazer Low sacai KAWS Neptune Blue due to the initial bug that increased scarcity.

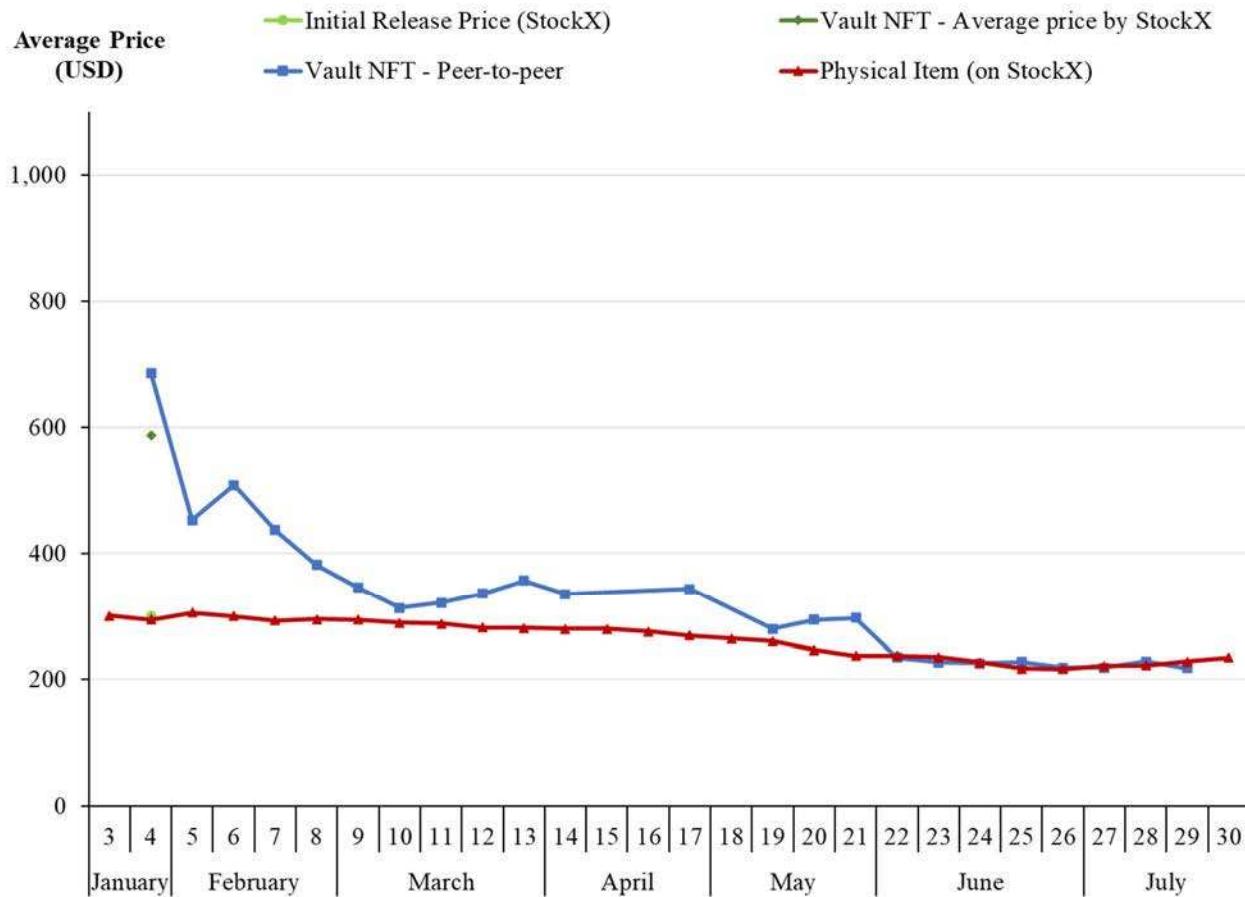
**Exhibit 4: Weekly Average Prices of Nike Blazer Low sacai KAWS Neptune Blue Sneakers<sup>185</sup>**



**Notes:**

- [1] All Vault NFTs for this model were released by StockX on January 18, 2022.
- [2] This chart shows the weekly average price of physical sneaker and Vault NFT transactions, using the variable for Gross Monetary Value. “Vault NFT – Average price by StockX” reflects the average release price of the Vault NFTs that were not sold at the initial release price. “Physical Item (on StockX)” refers to the average price of the associated physical sneaker on StockX. StockX’s initial release price and the average release price differ, as StockX had to release some of their NFTs at market value, rather than their initial price, due to a bug.

<sup>185</sup> StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026. See also StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216 (providing release prices).

**Exhibit 5: Weekly Average Prices of Air Jordan 1 Retro High OG Patent Bred Sneakers<sup>186</sup>**

<sup>186</sup> StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026. See also StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216 (providing release prices).

traded on StockX,<sup>187</sup> and 14% higher when looking at April and May together.<sup>188</sup> Further, looking at transactions of Vault NFTs associated with Nike shoes between April 1 and May 25, 2022,<sup>189</sup> prices ranged between \$143 and \$479, for an average close to \$300.<sup>190</sup> Contrary to the description in the First Amended Complaint, at this time, there were no “Nike-branded Vault NFTs [] still selling for thousands of dollars above the price of the physical shoe.”<sup>191</sup>

**B. The evolution of Vault NFT prices is similar to that of many other novel asset classes subject to irrational exuberance among users**

82. High initial prices followed by a price decline for traded assets—otherwise known as bubbles—are not unusual in contexts where traders are uncertain about the true value of the underlying technology. The price dynamics observed for StockX’s Vault NFTs are therefore not unlike the ones seen for a range of assets linked to other new technologies since the nineteenth century. The causes for these bubbles have been studied extensively by economists in the past decades. In the case of Vault NFTs, the uncertainty regarding the valuation of the new asset, the underlying technology, and the expected adoption rate of the new vault service may have caused high initial demand followed by a rapid correction, possibly once uncertainty and initial over-excitement faded.

83. Plentiful economic research has studied the dynamics of irrational over-investments motivated by “fads and fashions, overconfidence and related psychological biases that might lead to momentum trading, trend chasing, and the like.”<sup>192</sup> This phenomenon has been

<sup>187</sup> This percentage corresponds to the ratio of the average peer-to-peer price over the average physical price in May 2022. These ratios are calculated individually for each model, and then weighted by the count of peer-to-peer Vault NFTs sold in May. See StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026.

<sup>188</sup> This percentage corresponds to the ratio of the average peer-to-peer price over the average physical price in April and May 2022. These ratios are calculated individually for each model, and then weighted by the count of peer-to-peer Vault NFTs sold in April and May. See StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026.

<sup>189</sup> The First Amended Complaint was filed on May 25, 2022.

<sup>190</sup> \$299.5 is the average of each Vault NFT’s average peer-to-peer price, weighted by the number of Vault NFT transactions of each model between April 1 and May 25, 2022. See StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026.

<sup>191</sup> First Amended Complaint, ¶ 65.

<sup>192</sup> Dilip Abreu and Markus Brunnermeier, “Bubbles and Crashes,” *Econometrica*, Vol. 71, No. 1, 2003, pp. 173-204.

called irrational exuberance—a term coined by then-Federal Reserve Board chairman Alan Greenspan when talking about the dot-com bubble in the 1990s—and memorialized by Nobel-prize economist Robert Shiller in his seminal book *Irrational Exuberance*.<sup>193</sup> Shiller describes the Dutch tulip mania in the 1630s as the first speculative bubble of importance driven by irrational exuberance, and he has more recently described Bitcoin as a financial bubble driven by irrational exuberance.<sup>194</sup> Further, numerous studies have shown that bubbles consistently form in laboratory experiments, and are driven by investor behavior, including by irrationality exhibited by investors at the beginning of experiments.<sup>195</sup> These asset price bubbles form in laboratory experiments even when investors have common knowledge of the fundamental value of the asset.<sup>196</sup>

84. Uncertainty is a common cause of initial overinvestment in assets and, therefore, inflated prices.<sup>197</sup> This is particularly the case for assets linked to new technologies, “when

<sup>193</sup> Robert Shiller, *Irrational Exuberance* 3rd Ed., Princeton, NJ, Princeton University Press, 2016.

<sup>194</sup> Cointelegraph, “Nobel Prize Winner Uses Bitcoin as Example of Irrational Exuberance,” September 5, 2017, <https://cointelegraph.com/news/nobel-prize-winner-uses-bitcoin-as-example-of-irrational-exuberance> (When asked about a current example of irrational exuberance or a speculative bubble, Shiller claims “The best example right now [of irrational exuberance] is Bitcoin.”).

<sup>195</sup> Gunduz Caginalp, David Porter, and Vernon Smith, “Overreaction, Momentum, Liquidity, and Price Bubbles in Laboratory and Field Asset Markets,” *Journal of Psychology and Financial Markets*, Vol. 1, 2000, pp. 24-48, p. 24 (“What drives stock prices? Certainly earnings—or more generally, fundamental value—play a role. Investor behavior, however, is increasingly considered as another important factor.”). See also Vivian Lei, Charles Noussair, and Charles Plott, “Nonspeculative Bubbles in Experimental Asset Markets: Lack of Common Knowledge of Rationality vs. Actual Irrationality,” *Econometrica*, Vol. 69, No. 4, 2001, pp. 831-859, p. 858 (“A full investigation of the reasons behind the bubble phenomenon is far beyond the scope of a single set of experiments or a single paper. However, a brief description of what we think we have seen in our experiment might be useful. The behavior exhibited by the asset markets over time appears to have stages not unlike the stages that have been postulated for other experiments (Plot (1996)). The beginning involves some confusion and irrationality.”), p. 831 (“A bubble is operationally defined as ‘trade in high volumes at prices that are considerably at variance from intrinsic values.’ The result has been replicated and shown to be robust to several changes in the experimental design (see, for example, King et al. (1993), Fisher and Kelly (2000), Porter and Smith (1995), Van Boening, Williams, and LeMaster (1993).”).

<sup>196</sup> Vivian Lei, Charles Noussair, and Charles Plott, “Nonspeculative Bubbles in Experimental Asset Markets: Lack of Common Knowledge of Rationality vs. Actual Irrationality,” *Econometrica*, Vol. 69, No. 4, 2001, pp. 831-859, pp. 831-832 (“In all of these studies, markets are created for assets with a lifetime of a finite number of periods (typically 15 or 30 periods) ... The dividend paid is identical for each trader and the dividend process is common knowledge to all traders. Rather than tracking the fundamental value, the market price time series is usually characterized by a ‘boom’ phase, a period of time in which prices are higher than fundamental values, often followed by a ‘crash,’ a sudden rapid drop in price.”).

<sup>197</sup> Brent Goldfarb and David Kirsch, *Bubbles and Crashes: The Boom and Bust of Technological Innovation*, Stanford, CA, Stanford University Press, 2019, p. 22 (“The financial economics literature has suggested that bubbles are more likely to occur under greater uncertainty and that speculation will end as this uncertainty is resolved.”).

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investors have trouble understanding how a technology will fit into [the] system, or alternatively, when it is surmised that a new technology might displace extensive portions of a value chain, then this will encourage investment.”<sup>198</sup> Economic research has found that many of the major technological innovations of the nineteenth and twentieth centuries, such as the steam engine train, the telegraph, the airplane, or the personal computer have been accompanied by bubbles in the stock price of parent firms.<sup>199</sup> For many new products however, initial uncertainty and price volatility tends to correct quickly once investors better understand the product and its value.<sup>200</sup>

85. More recently, analyses of trends in crypto asset markets have shown that cryptocurrencies and other decentralized finance innovations are prone to speculative bubbles, generally attributable to uncertainty in the future value of the assets, a lack of understanding of fundamentals, and irrational exuberance. For instance, a literature review of investor behavior in the cryptocurrency markets concluded, “the crypto market is dominated by irrational investors, who base their investment decisions on market sentiment,” and that “the uncertainty of fundamentals leads to investors’ dispersed beliefs, leading to high trading and speculative bubbles.”<sup>201</sup> Another paper, which studied the price patterns of 14 crypto assets—including two cryptocurrencies, nine DeFi tokens, and three tokenized NFTs tradeable on cryptocurrency exchanges—documented bubbles for the three types of assets.<sup>202</sup> Recent research on Initial Coin Offerings (ICOs), which are used to issue crypto tokens and have emerged as an alternative

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<sup>198</sup> Brent Goldfarb and David Kirsch, *Bubbles and Crashes: The Boom and Bust of Technological Innovation*, Stanford, CA, Stanford University Press, 2019, p. 22.

<sup>199</sup> Alina Sorescu, Sorin M. Sorescu, Will J. Armstrong, and Bart Devoldere, “Two Centuries of Innovations and Stock Market Bubbles,” *Marketing Science*, Vol. 37, No. 4, 2018, pp. 507-529, p. 525 (“We examine 51 major innovations that were commercialized during the 19<sup>th</sup> and 20<sup>th</sup> centuries. In 37 of these 51 cases, we detect the presence of bubbles in the stock price of parent firms.”).

<sup>200</sup> Brent Goldfarb and David Kirsch, *Bubbles and Crashes: The Boom and Bust of Technological Innovation*, Stanford, CA, Stanford University Press, 2019, p. 22 (“The financial economics literature has suggested that bubbles are more likely to occur under greater uncertainty and that speculation will end as this uncertainty is resolved.”).

<sup>201</sup> José Almeida and Tiago Cruz Gonçalves, “A Systematic Literature Review of Investor Behavior in the Cryptocurrency Markets,” *Journal of Behavioral and Experimental Finance*, Vol. 37, 2023, pp. 1-18, p. 14.

<sup>202</sup> Youcef Maouchi, Lanouar Charfeddine, and Ghassen El Montasser, “Understanding Digital Bubbles Amidst the COVID-19 Pandemic: Evidence from DeFi and NFTs,” *Finance Research Letters*, Vol. 47, 2022, pp. 1-8, p. 5 (“[W]e find that the average magnitude, measured as the price increase per bubble day, is much higher for DeFi and NFTs compared to pure cryptocurrencies … However, DeFi and NFTs experience less bubbles compared to pure cryptocurrencies.”).

channel for start-up financing, describes a “relatively new and complex” market,<sup>203</sup> “a novel mechanism”<sup>204</sup> with which investors have limited experience and that is surrounded by much uncertainty.<sup>205</sup> A prominent form of ICOs is where issued digital tokens function as an exclusive medium of exchange on a new platform or represent access to a new product or service. Because these tokens are easily tradable, price volatility is high and based on the market’s perception of the underlying project.<sup>206</sup> Uncertainty arises from the fact that, while such “tokens are worthless when the platform is small and processes a small number of transactions, these tokens appreciate in value as the platform scales, automatically rewarding early contributors for taking risk and supporting its development when its success was uncertain.”<sup>207</sup>

86. In the case of Vault NFTs, the uncertainty is compounded by the fact that Vault NFTs are what economists call a network technology. A network technology is characterized by the presence of network externalities linked to technology adoption: the value of the technology for a given user depends on the adoption rate of others. One example of such technology, which I

<sup>203</sup> Sabrina Howell, Marina Niessner, and David Yermack, “Initial Coin Offerings: Financing Growth With Cryptocurrency Token Sales,” *NBER Working Paper 24774*, 2019, pp. 1-64, p. 1 (“Initial coin offerings (ICOs) are a new method of raising capital for early stage ventures, an alternative to more traditional sources of start-up funding such as venture capital (VC) and angel finance.”); Avtar Sehra, *Economics of Initial Coin Offerings*, August 2017, [https://www.researchgate.net/publication/351626829\\_Economics\\_of\\_Initial\\_Coin\\_Offerings](https://www.researchgate.net/publication/351626829_Economics_of_Initial_Coin_Offerings), p. 2 (“The market for Initial Coin Offerings (ICOs) is a relatively new and complex phenomenon, which consists of organisations issuing transferrable tokens to the general public.”).

<sup>204</sup> Christian Catalini and Joshua Gans, “Initial Coin Offerings and Value of Crypto Tokens,” *Social Science Research Network*, 2019, pp. 1-37, p. 2 (“Initial coin offerings (ICOs) have emerged as a novel mechanism for financing entrepreneurial ventures. Through an ICO, a venture offers a stock of specialized crypto tokens for sale with the promise that those tokens will operate as the only medium of exchange when accessing the venture’s future products.”).

<sup>205</sup> John Conley, “Blockchain and the Economics of Crypto-tokens and Initial Coin Offerings,” *Vanderbilt University Department of Economics Working Papers*, 2017, pp. 1-18, p. 12 (“Tokens are new thing. Investors don’t have much experience with them so they may not be very good at estimating their value. In addition, blockchain is a relatively new technology and there is a great deal of uncertainty [sic] over how much potential for profit there is and which sectors are the right ones to invest in.”).

<sup>206</sup> Avtar Sehra, *Economics of Initial Coin Offerings*, August 2017, [https://www.researchgate.net/publication/351626829\\_Economics\\_of\\_Initial\\_Coin\\_Offerings](https://www.researchgate.net/publication/351626829_Economics_of_Initial_Coin_Offerings), p. 6 (“As discussed in the introduction, this is where the issued digital token represents access to some product or service that either already exists or will exist in the future. .... However, unlike normal licenses these issued tokens are easily transferable, either directly between users (over the counter) or through an established cryptocurrency exchange. This ease of transferability of the tokens on an exchange enables liquidity and thus drives price volatility based on the market’s perception of the issuing project.”).

<sup>207</sup> Christian Catalini and Catherine Tucker, “Antitrust and Costless Verification: an Optimist and a Pessimistic View of the Implications of Blockchain Technology,” *Antitrust Law Journal*, Vol. 82, No. 3, 2019, pp. 861-872, pp. 866-867.

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have described in my research, is video-messaging.<sup>208</sup> When Skype launched as one of the first video-messaging services, its value to one person depended on how many others had adopted the software and were available for calls. Similarly, the value of a Vault NFT for one person depends on how many others will adopt the technology. This idea can be illustrated by considering the potential for savings on shipping and authentication costs. Whether these savings will be realized depends on the likelihood that one Vault NFT owner interested in selling will be able to find a buyer interested in acquiring the digital asset. If no one wants to buy the Vault NFT, the owner will need to retrieve the shoes from the StockX Vault—paying a \$35 withdrawal fee, shipping fees, and sales taxes<sup>209</sup> in the process—and list them on StockX or another platform, where they will again incur fees associated with verification and shipment of the shoes (see Exhibit 2). However, if the Vault NFT is an accepted technology, owners will be able to sell these assets without incurring those costs. Furthermore, the more times a Vault NFT is traded before the physical pair of shoes is redeemed, the greater the potential savings in shipping and authentication costs. Therefore, the expected benefits of the technology vary depending on future technology adoption. In the case of a network technology, the valuation of a product by early investors depends on those investors’ beliefs regarding technology adoption.

87. In addition, some investors may consciously invest in a new technology at elevated prices if they have the confidence that, even if the asset is overvalued, there is a sufficiently high chance that subsequent buyers will pay an even higher price for the asset. These types of investors, which have been called rational arbitrageurs in the literature, understand that the asset price will ultimately decline, but nevertheless choose to purchase it at an inflated price in an attempt to “ride the bubble.”<sup>210</sup> This type of behavior has been documented in cases

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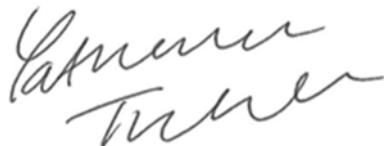
<sup>208</sup> Catherine Tucker, “Identifying Formal and Informal Influence in Technology Adoption with Network Externalities,” *Management Science*, Vol. 54, No. 12, 2008, pp. 2024-2038.

<sup>209</sup> StockX, “What fees are associated with Vault NFTs?,” April 14, 2022, <https://stockx.com/help/articles/What-fees-are-associated-with-Vault-NFTs> (“Vault NFTs have additional fees to withdraw your item. When withdrawing a Vault NFT, customers are subject to a \$35 withdrawal fee, shipping, and any applicable sales tax.”).

<sup>210</sup> Dilip Abreu and Markus Brunnermeier, “Bubbles and Crashes,” *Econometrica*, Vol. 71, No. 1, 2003, pp. 173-204, p. 174 (“We study the impact of rational arbitrage in this setting. We suppose that rational arbitrageurs understand that the market will eventually collapse but meanwhile would like to ride the bubble as it continues to grow and generate high returns. Ideally, they would like to exit the market just prior to the crash, to ‘beat the gun’ in Keynes’ colorful phrase.”).

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including the South Sea Bubble or the Technology Bubble.<sup>211</sup> The rational arbitrageurs’ willingness to pay is therefore rooted in their expectations about what other potential buyers will be willing to pay. To the extent that a new asset is seen by rational arbitrageurs as likely to achieve widespread adoption and likely to produce excitement and purchase interest, this perception can facilitate higher willingness to pay by the rational arbitrageurs. Similarly, it is possible that some early investors in Vault NFTs thought they were overvalued compared to the physical shoes but were expecting the demand to grow such that they could plan on reselling at an even higher price at a future date.

A handwritten signature in black ink that reads "Catherine Tucker".

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Catherine Tucker, Ph.D.

<sup>211</sup> Peter Temin and Hans-Joachim Voth, “Riding the South Sea Bubble,” *American Economic Review*, Vol. 94, No. 5, 2004, pp. 1654-1668, p. 1654 (“This paper presents a case study of a well-informed investor in the South Sea bubble. We argue that Hoare’s Bank … knew that a bubble was in progress and nonetheless invested in the stock; it was profitable to ‘ride the bubble.’”); Markus Brunnermeier and Stefan Nagel, “Hedge Funds and the Technology Bubble,” *The Journal of Finance*, Vol. 59, No. 5, 2004, pp. 2013-2040, p. 2014 (“First, our analysis indicates that hedge funds were riding the technology bubble. Over our sample period 1998 to 2000, hedge fund portfolios were heavily tilted toward highly priced technology stocks. The proportion of their overall stock holdings devoted to this segment was higher than the corresponding weight of technology stocks in the market portfolio … Second, we find that that the hedge funds in our sample skillfully anticipated price peaks of individual technology stocks … As a result, hedge fund managers captured the upturn, but avoided much of the downturn.”).

## APPENDIX A

### CATHERINE TUCKER

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#### EDUCATION

Stanford University, Ph.D. in Economics (Advisor: Tim Bresnahan), 2005

Oxford University, BA in Politics, Philosophy and Economics, 1999

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#### APPOINTMENTS

MIT Sloan, Faculty Chair EMBA Program, July 2022 –

MIT Sloan, Sloan Distinguished Professor of Management Science, September 2015 –

MIT Sloan, Chair MIT Sloan PhD Program, July 2015 -2022

MIT Sloan, Professor of Management Science, July 2015 –

MIT, Co-Founder of the MIT CryptoEconomics Lab, 2018 -

National Bureau of Economic Research (NBER), Research Associate, September 2012 –

MIT Sloan, Mark Hyman Jr. Career Development Professor (with tenure), July 2012 –  
September 2015

MIT Sloan, Associate Professor of Management Science, July 2011 – July 2015

National Bureau of Economic Research (NBER), Faculty Research Fellow, May 2011 –  
September 2012

MIT Sloan, Douglas Drane Career Development Chair in IT and Management, July 2006 –

MIT Sloan, Assistant Professor of Marketing, July 2005 – June 2011

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## HONORS AND AWARDS

2020	CITI Fellowship (Columbia University Institute of TeleInformation)
2020	O'Dell Award
2020	TechSIG-Lazaridis Prize for Best Paper in Innovation, Technology and Interactivity for 2019
2018	ISMS Long Term Impact Award
2018	O'Dell Award
2018	MSI Scholar
2017	Congressional Testimony on 'Algorithms: How Companies' Decisions About Data and Content Impact Consumers'
2017	Nominated for Teacher of the Year award (Also in 2012, 2010 and 2009)
2015	Erin Anderson Award
2014	Paul E. Green Award
2013	Teacher of the Year Award, MIT Sloan
2013	Jamieson Prize for Excellence in Teaching
2012	Garfield Economic Impact Award for Best Paper in Health Economics
2011	WHITE Award for best paper in the Economics of Healthcare IT
2011	Public Utility Research Prize for the best paper in regulatory economics
2011	NSF CAREER Award
2011	MSI Young Scholar
2010	Management Science Distinguished Service Award
2004	Koret Foundation Scholar, Stanford Institute for Economic Policy Research Fellowship
2004	Fourth Annual Claire and Ralph Landau Student Working Paper prize

## PUBLISHED/ACCEPTED PAPERS

1. 'Identifying Formal and Informal Influence in Technology Adoption with Network Externalities', *Management Science*, Vol. 55 No. 12, December 2008, pp. 2024-2039
2. 'Privacy Protection and Technology Diffusion: The Case of Electronic Medical Records' with Amalia Miller, *Management Science (Lead Article)*, Vol. 55 No. 7, July 2009, pp.

1077-1093

- Republished as part of INFORMS 'Healthcare in the Age of Analytics' series
3. 'How Sales Taxes Affect Customer and Firm Behavior: The Role of Search on the Internet' with Eric Anderson, Nathan Fong and Duncan Simester, *Journal of Marketing Research*, Vol. 47 No. 2, April 2010, pp. 229-239
  4. 'Growing Two-sided Networks by Advertising the User Base: A Field Experiment', with Juanjuan Zhang, *Marketing Science*, Vol. 29 No. 5, September-October 2010, pp. 805-814
  5. 'Privacy Regulation and Online Advertising' with Avi Goldfarb, *Management Science*, Vol. 57 No. 1, January 2011, pp. 57-71
    - Nominated for Long Term Impact Award 2020
  6. 'Search Engine Advertising: Channel Substitution when Pricing Ads to Context', with Avi Goldfarb, *Management Science*, Vol. 57 No 3, March 2011, pp. 458-470
  7. 'Stuck in the Adoption Funnel: The Effect of Interruptions in the Adoption Process on Usage' with Anja Lambrecht and Katja Seim, *Marketing Science*, Vol. 30 No. 2, March-April 2011, pp. 355-36
  8. 'Advertising Bans and the Substitutability of Online and Offline Advertising', with Avi Goldfarb, *Journal of Marketing Research (Lead Article)*, Vol. 48 No. 2, April 2011, pp. 207-227
  9. 'Can Healthcare Information Technology Save Babies?' with Amalia Miller, *Journal of Political Economy*, Vol. 119 No. 2, April 2011, pp. 289-324
  10. 'How Does Popularity Information Affect Choices? A Field Experiment' with Juanjuan Zhang, *Management Science*, Vol. 57 No. 5, May 2011, pp. 828-842
  11. 'Online Display Advertising: Targeting and Obtrusiveness' with Avi Goldfarb, *Marketing Science (Lead Article and Discussion Paper)*, Vol. 30 No. 3, May-June 2011, pp. 389-404
    - 'Rejoinder - Implications of "Online Display Advertising: Targeting and Obtrusiveness' with Avi Goldfarb, *Marketing Science*, Vol. 30 No. 3, May-June 2011, pp. 413-415
    - Nominated for John D. C. Little Award
    - Nominated for Long Term Impact Award 2017

- Long Term Impact Award 2018
12. 'Encryption and Data Security' with Amalia Miller, *Journal of Policy Analysis and Management*, Vol. 30 No. 3, Summer 2011, pp. 534-556
13. 'Paying With Money or With Effort: Pricing When Customers Anticipate Hassle' with Anja Lambrecht, *Journal of Marketing Research*, Vol. 49 No. 1, February 2012, pp. 66-82.
14. 'Heterogeneity and the Dynamics of Technology Adoption' with Stephen Ryan, *Quantitative Marketing and Economics*, Vol 10 No. 1, March 2012, pp 63-109
15. 'Shifts in Privacy Concerns', *American Economic Review: Papers and Proceedings* with Avi Goldfarb, Vol. 102 No. 3, May 2012, pp. 349-53
16. 'How does the Use of Trademarks by Intermediaries Affect Online Search?' with Lesley Chiou. *Marketing Science*, Vol 31 No. 5, September 2012, pp 819-837
17. 'Active Social Media Management: The Case of Health Care' with Amalia Miller. *Information Systems Research*, Vol. 24 No. 1, March 2013, pp. 52-70
  - Republished as part of Informs 'Healthcare in the Age of Analytics' series
18. 'Paywalls and the Demand for News' with Lesley Chiou. *Information Economics and Policy*, Vol. 25 No. 2, June 2013, pp. 61-69
19. 'Days on Market and Home Sales' with Juanjuan Zhang and Ting Zhu. *RAND Journal of Economics*, Vol. 44 No. 2, Summer 2013, pp. 337-360,
20. 'When Does Retargeting Work? Timing Information Specificity' with Anja Lambrecht. *Journal of Marketing Research (Lead Article)* Vol. 50 No. 5, October 2013, pp. 561-576
  - Paul E. Green Award for the 'Best article in the Journal of Marketing Research that demonstrates the greatest potential to contribute significantly to the practice of marketing research.'
  - William O'Dell Award. This award honors the JMR article published in 2013 that has made the most significant, long-term contribution to marketing theory, methodology, and/or practice
21. 'Health Information Exchange, System Size and Information Silos' with Amalia Miller. *Journal of Health Economics*, Vol. 33 No. 2, January 2014: pp. 28-42

22. 'Electronic Discovery and the Adoption of Information Technology' with Amalia Miller. *Journal of Law, Economics, & Organization (Lead Article)*, Vol. 30. No. 2, May 2014, pp. 217-243
23. 'Social Networks, Personalized Advertising, and Privacy Controls.', *Journal of Marketing Research*, Vol. 51 No. 5, October 2014, pp. 546-562.
- Citation of Excellence Award Emerald Publishing
  - Nominated for William O'Dell Award (2019)
24. 'Trademarks, Triggers, and Online Search' with Stefan Bechtold. *Journal of Empirical Legal Studies*, Vol. 11 No. 4, December 2014
25. 'The Reach and Persuasiveness of Viral Video Ads' *Marketing Science*, Vol. 34 No. 2, 2015, pp. 281-296
26. 'Privacy Regulation and Market Structure' with James Campbell and Avi Goldfarb. *Journal of Economics & Management Strategy*, Vol 24, No. 1, Spring 2015, pp. 47-73
27. 'Standardization and the Effectiveness of Online Advertising' with Avi Goldfarb. *Management Science*, Vol. 61 No. 11, 2015, pp. 2707-2719
28. 'Harbingers of Failure' with Eric Anderson, Song Lin and Duncan Simester. *Journal of Marketing Research (Lead Article)*, Vol. 52 No. 5, Oct 2015, pp. 580-592
- William O'Dell Award. This award honors the JMR article published in 2015 that has made the most significant, long-term contribution to marketing theory, methodology, and/or practice
29. 'The Effect of Patent Litigation and Patent Assertion Entities on Entrepreneurial Activity' with Stephen Kiebzaka. and Greg Rafert. *Research Policy*, Vol. 45 No. 1, February 2016, pp. 218-231
30. 'When early adopters don't adopt' with Christian Catalini. *Science*, Vol. 357, Issue 6347, 2017 pp. 135-136
31. 'Network Stability, Network Externalities, and Technology Adoption' in *Advances in Strategic Management*, Vol. 37, 2017, pp.151 - 175
32. 'Digital Content Aggregation Platforms: The Case of the News Media.' with Lesley Chiou - *Journal of Economics & Management Strategy*, Vol. 26 No. 4, 2017, pp. 782-805

33. 'Should You Target Early Trend Propagators? Evidence from Twitter' with Anja Lambrecht and Caroline Wiertz (Lead Article). *Marketing Science*, Vol. 37 No. 2, 2018, pp. 177-199
34. 'Privacy Protection, Personalized Medicine and Genetic Testing' with Amalia Miller. *Management Science*, Vol. 64 No. 10, 2018, pp. 4648-4668.
35. 'Digital Economics' with Avi Goldfarb, *Journal of Economic Literature*, Vol. 57 No. 1, 2019, pp. 3-43
36. Collusion by Algorithm: Does Better Demand Prediction Facilitate Coordination Between Sellers? with Jeanine Miklós-Thal *Management Science*, Vol. 65 No. 4, 2019, pp. 1552-1561
37. 'Algorithmic Bias? An Empirical Study into Apparent Gender-Based Discrimination in the Display of STEM Career Ads ' with Anja Lambrecht. *Management Science* 2019, Vol 65, No 7, pp. 2966-2981
  - TechSIG-Lazaridis Prize for Best Paper in Innovation, Technology and Interactivity for 2019
38. 'How Effective Is Black-Box Digital Consumer Profiling And Audience Delivery?: Evidence from Field Studies' with Nico Neumann and Tim Whitfield. *Marketing Science*, Dec, 2019, Vol 38, No 6, pp. 918-926 (Lead Article)
39. The Surprising Breadth of 'Harbingers of Failure' with Duncan Simester and Clair Yang. *Journal of Marketing Research* 2019, Vol 56, No. 6, pp 1034-1049
40. 'Consumer privacy and the future of data-based innovation and marketing.' with Alexander Bleier and Avi Goldfarb. *International Journal of Research in Marketing* Volume 37, Issue 3, September 2020, Pages 466-480
41. 'Informational Challenges in Omnichannel Marketing: Remedies and Future Research' with Tony Cui, Anindya Ghose, Hanna Halaburda, Raghuram Iyengar, Koen Powels, S. Siriam, and Sriraman Vankatarman. *Journal of Marketing* 2021, Vol. 85(1) 103-120
42. 'Product Quality and Performance in the Internet Age: Evidence from Creationist Friendly Curriculum' with Ananya Sen. *Journal of Marketing Research* 2022, Vol 59, No.1, pp :211-29
43. 'Conducting Research in Marketing with Quasi-Experiments' with Avi Goldfarb and Yanwen Wang, (Lead Article) *Journal of Marketing* 2022, Vol 86, No 3, pp 1-20.

44. ‘How Do Restrictions on Advertising Affect Consumer Search?’ with Lesley Chiou, *Management Science*, 2022, Vol. 68, No. 2, pp. 866-882.
45. ‘Privacy Regulation and Barriers to Public Health’ with Joe Buckman and Idris Adjerid. Forthcoming at *Management Science*, 2022
46. ‘What Blockchain Can and Can’t Do: Applications to Marketing and Privacy’ with Alex Marthews. Forthcoming at *International Journal of Research in Marketing*
47. What Type of Digital Advertising is Most Effective for B2B Prospecting? The Case of IT Decision-Makers with Nico Neumann, Kumar Subramanyam and John Marshall Conditionally accepted at *Quantitative Marketing and Economics*
48. ‘TV Advertising and Online Sales: The Role of Inter-Temporal Substitution’ with Anja Lambrecht and Xu Zhang Conditionally accepted at *Journal of Marketing Research*
49. Data Deserts and Black Boxes: The Impact of Socio-Economic Status on Consumer Profiling with Nico Neumann, Levi Kaplan, Alan Mislove, and Piotr Sapiezyński. Conditionally accepted *Management Science*

#### CHAPTERS IN EDITED VOLUMES AND SUMMARY PIECES

50. ‘Modeling Social Interactions: Identification, Empirical Methods and Policy Implications’ with Wes Hartmann, Puneet Manchanda, Harikesh Nair, Matt Bothner, Peter Dodds, David Godes and Karthik Hosanagar, *Marketing Letters*, Vol. 19 No. 3, December 2008, pp. 287-304
51. ‘Search Engine Advertising - Examining a profitable side of the long tail of advertising that is not possible under the traditional broadcast advertising model’ with Avi Goldfarb, *Communications of the ACM*, Vol. 51 No. 11, November 2008, pp. 22-24
52. ‘Online Advertising’, with Avi Goldfarb, *Advances in Computers*, Vol. 81, March 2011, Marvin Zelkowitz (Ed), Elsevier
53. ‘Substitution between Online and Offline Advertising Markets’, with Avi Goldfarb, *Journal of Competition Law and Economics*, Vol. 7 No. 1, March 2011, pp. 37-44
54. ‘Online Advertising, Behavioral Targeting, and Privacy’, with Avi Goldfarb, *Communications of the ACM*, Vol. 54 No. 5, May 2011, 25-27
55. ‘Privacy and Innovation’, *Innovation Policy and the Economy*, Vol. 11, 2012, Josh Lerner and Scott Stern (Eds), NBER

56. 'The Economics of Advertising and Privacy', *International Journal of Industrial Organization*, Vol. 30 No. 3, May 2012, pp. 326-329
57. 'Empirical Research on the Economic Effects of Privacy Regulation'. *Journal on Telecommunications and High Technology Law*, Vol. 10 No. 2, Summer 2012, pp. 265-272
58. 'Social Networks, Advertising and Antitrust', with Alex Marthews, *George Mason Law Review*, 2012, Vol 19 No 5., pp. 1211-1227.
59. 'Why Managing Customer Privacy Can Be an Opportunity' with Avi Goldfarb, *Spring 2013, Sloan Management Review*
60. 'The Implications of Improved Attribution and Measurability for Antitrust and Privacy in Online Advertising Markets', *George Mason Law Review*, Vol. 2 No. 2, pp. 1025-1054 (2013).
61. 'Patent Trolls and Technology Diffusion' Chapter in NBER book 'Standards, Patents and Innovations' (2014), Timothy Simcoe, Ajay K. Agrawal, and Stuart Graham
62. 'Privacy and the Internet' Chapter 11, *Handbook of Media Economics*, 2016, Edited by Simon Anderson and Joel Waldfogel
63. Frontiers of Health Policy: Digital Data and Personalized Medicine, *Innovation Policy and the Economy*, Vol. 15, 2016, Josh Lerner and Scott Stern (Eds), NBER
64. 'Impacts of Surveillance on Behavior' with Alex Marthews, in Gray, David C. and Henderson, Stephen (Editors), *The Cambridge Handbook of Surveillance Law* (2017).
65. 'On Storks and Babies: Correlation. Causality and Field Experiments,' with Anja Lambrecht, *GfK Marketing Intelligence Review*, Vol 8. No 2. 2016
66. 'Field Experiments in Marketing,' with Anja Lambrecht, *Handbook of Marketing Analytics*, Edited by Natalie Mizik and Dominique Hanssens, Edward Elgar Publishing, (2018)
67. 'Can Big Data Protect a Firm from Competition?', *CPI Chronicle*, January, 2017 with Anja Lambrecht
68. Network Effects and Market Power: What Have We Learned in the Last Decade? *Antitrust* Vol. 32 No 2., Spring 2018
69. 'Inequality, Privacy and Digital Market Design', with Avi Goldfarb, Chapter in *Fair by Design* edited by Scott Kominers and Alex Teytelboym, 2017, Oxford University Press

70. ‘Digital Data, Platforms and the Usual [Antitrust] Suspects: Network Effects, Switching Costs, Essential Facility’ *Review of Industrial Organization* Volume 54, pp 683–694 (2019)
  71. ‘Antitrust and Costless Verification: An optimistic and a pessimistic view of the implications of blockchain technology’ with Christian Catalini, *Antitrust Law Journal* - Volume 82 Issue 3, 2019
  72. Online Advertising and Antitrust: Network Effects, Switching Costs and Data as an Essential Facility. April 2019, ‘*Competition Policy International*’
  73. Blockchain and Identity Persistence, with Alex Marthews, Chapter in *Cryptoassets: Legal, Regulatory, and Monetary Perspective*, edited by Chris Brummer, Oxford University Press, 2019.
  74. ‘Digital Marketing,’ with Avi Goldfarb, in the *Handbook of the Economics of Marketing*, Volume 1, edited by JP-Dube and Peter Rossi, pp. 259-290, Elsevier
  75. ‘Privacy Policy and Competition’, with Alex Marthews. *Brookings Papers*
  76. Digital Infrastructure: Does the ‘Coring’ of Digital Platforms make them part of Digital Infrastructure?.” (2020) in ‘Economic Analysis and Infrastructure Investment’ edited by Edward L. Glaeser and James M. Poterba, University of Chicago Press
  77. Competition in the Digital Advertising Market, The Global Antitrust Report on the Digital Economy (2021)
  78. How Platforms Create Value Through Coring and Implications for Market Definition, *Competition Policy International* (2022)
  79. Digital Disruption in Schooling and the Pandemic: Documenting the Digital Infrastructure Divide Among School Children with Ananya Sen, Societal Experts Action (2022) Network
  80. Algorithmic Exclusion, *Brookings Paper*, (2022)
- 

#### BOOKS EDITED

81. The Evolution of Antitrust in the Digital Era: Essays on Competition Policy, with David Evans and Alan Fels Ao. November 9, 2020

82. Blockchain: The Insights You Need from Harvard Business Review (HBR Insights Series), 2019
  83. Economic Analysis of the Digital Economy, University of Chicago Press, 2015, with Avi Goldfarb and Shane Greenstein
  84. The Economics of Digitization, Edward Elgar Publishing, 2013., with Avi Goldfarb and Shane Greenstein
- 

#### POLICY WRITING

85. OECD Roundtable on Privacy, Report on the 'Economic Value of Online Information', December 2010
  86. Written Congressional Testimony on 'Internet Privacy: The Impact and Burden of European Regulation,' U.S. House Energy and Commerce Committee, September 2011
  87. Written Congressional Testimony on 'Algorithms: How Companies' Decisions About Data and Content Impact Consumers,' U.S. House Energy and Commerce Committee, November 2017
- 

#### PAPERS UNDER REVIEW

88. 'Social Advertising: How Advertising that Explicitly Promotes Social Influence Can Backfire'. Revise and resubmit at *Management Science*
89. 'Patent Trolls and Technology Diffusion: The Case of Medical Imaging' Revise and resubmit at *RAND Journal of Economics*
90. 'Third-Party Certification: The Case of Medical Devices' with Cristina Nistor Revise and resubmit at *Management Science*
91. 'Tensile Promotions in Display Advertising' with Anja Lambrecht Revise and resubmit at *Quantitative Marketing and Economics*
92. Choosing to Discover the Unknown: The Effects of Choice on Users' Attention to Online Video Advertising" with Jack Jiang Zhenhui and Cheng Luo and Cheng Yi and Xiuping Li Revise and resubmit at *Management Science*

93. ‘Guns, Privacy and Crime’ with Alessandro Acquisti Revise and resubmit at *Information Systems Research*
  94. ‘Does IT Lead to More Equal or More Unequal Treatment? An Empirical Study of the Effect of Smartphone Use on Social Inequality in Employee-Customer interactions’ with Shuyi Yu and Yifei Wang. Revise and Resubmit at *Information Systems Research*.
  95. The Effect of Subsidizing Digital Educational Content: Evidence from a Field Experiment with Jingcun Cao and Yifei Wang. Revise and resubmit at *Management Science*
  96. Algorithmic Influence: Empirical Evidence from Microlending with Jianfeng Guo, Xitong Li and Cathy Yang. Revise and Resubmit at *Information Systems Research*.
  97. Scaling Smart Contracts via Layer-2 Technologies: Some Empirical Evidence. with Wiliam Cong, Xiang Hui, and Luofeng Zhou, Revise and Resubmit at *Management Science*.
  98. ‘Apparent Algorithmic Discrimination and Real-Time Algorithmic Learning with Anja Lambrecht
  99. ‘The Digital Privacy Paradox: Small Money, Small Costs, Small Talk’ with Susan Athey and Christian Catalini, and Alex Moehring
  100. ‘Tradeoffs in Automated Political Advertising Regulation: Evidence from the COVID-19 Pandemic’ with Grazia Cecere, Clara Jean, and Vincent Lefrere
  101. ‘Social Distancing, Internet Access and Inequality’ with Leslie Chiou
  102. ‘The Shifters and Virality of Hate Speech Online’ with Uttara Ananthakrishnan
  103. Deplatforming and the Control of Misinformation: Evidence from Parler with Saharsh Agarwal and Uttara M Ananthakrishnan
  104. The Role of Delayed Data in the COVID-19 Pandemic, with Yifei Wang
- 

## WORK IN PROGRESS

### *Data Analysis*

105. ‘Big Bad Data: The Case of For-Profit College Advertising’ with Avinash Gannamaneni and Avi Goldfarb

106. ‘Selection and Inequality in Big Data’ with Amalia Miller
107. ‘Spillovers from Product Failure’ with Amalia Miller
108. ‘Rules For a Nascent Domain: Technological Innovation and Regulatory Uncertainty’ with Christian Catalini

*Data Collection*

109. ‘Mergers and Big Data: Evidence from Healthcare’ with Amalia Miller
110. ‘Privacy Regulation and Education IT’ with Amalia Miller and Avi Goldfarb
111. ‘The Lack of Appeal of Cross-Partisan Appeals: Evidence from an Experiment on Facebook’ with Christina KaChapelle
112. ‘The Resilience of Franchise Business Models: Evidence from the Pandemic’ with Avi Goldfarb and Verina Que

*Manuscripts*

113. ‘Data Privacy and Children: An Empirical Study of Mobile Applications’ with Grazia Cecere, Fabrice Le Guel, Vincent Lefrere, and Pai-Ling Yin
114. ‘Government Surveillance and Internet Search Behavior’ with Alex Marthews
115. ‘A New Method of Measuring Online Media Advertising Effectiveness: Prospective Meta-Analysis in Marketing’ with Gui Liberali, Glen L. Urban, Benedict G. Dellaert, Yakov C. Bart, and S. Stremersch.
116. **Empirically evaluating two-sided network effects: The case of electronic payments**
117. ‘Personalizing mental fit for online shopping applications - How the success of recommendations depends on mental categorization and mental budgeting’ with Oliver Emrich and Thomas Rudolph.

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INVITED SEMINARS

*Universities*

1. May 2023, University of Washington
2. May 2023, TOM Group, HBS
3. April 2023, Tilburg University

4. April 2023, Yale University
5. March 2023, Emory University
6. March 2023, University of Zurich, Cryptoeconomics group
7. February 2023, CBER Forum
8. February 2023, University of Arizona
9. February 2023, Columbia University, Marketing Group
10. February 2023, New York University, IS Group
11. November 2022, LSE, Marketing Group
12. September 2022, Advertising Research Group Amazon
13. March 2022, Marketing Group, Rotman, University of Toronto
14. March 2022, IT Group, Krannert School, Purdue University
15. November 2021, Tufts University, Economics Department
16. October 2021, McGill University, Marketing Group
17. September 2021, Stockholm Business School
18. May 2021, Safegraph Seminar
19. item April 2021, Marketing Science Institute
20. April 2021, George Mason University, Law and Economics Seminar
21. March 2021, Marketing Group, University of Michigan
22. March 2021, BIDT, Bavarian Academy of Sciences and Humanities
23. February 2021, University of Virginia, Law and Economics Seminar
24. January 2021, Marketing Group, Carnegie Mellon University
25. December 2020, Boston University, Boston Digital Leadership Forum
26. December 2020, Toulouse University, France
27. November 2020, Luohan Academy, Platform Economy and Market Dynamics, Virtual Seminar
28. November 2020, John Hopkins University
29. October 2020, Wharton, Marketing Group
30. October 2020, ITAM, Mexico City
31. September 2020, Econ, Stats and ML Team, Etsy
32. June 2020, CMU Seminar
33. April 2020, Virtual Digital Economy Seminar
34. March 2020, IS group, University of Minnesota
35. February 2020, Georgia Institute of Technology, GA
36. December 2019, HBS Field Experiments Seminar, Cambridge, MA
37. November 2019, Bank of Canada, Ottawa
38. May 2019, Joint-Economics Seminar, Autonomous University of Barcelona) and the IAE (Institute for Economic Analysis)
39. March 2019, LMU Center for Advanced Management Studies in Munich
40. February 2019, Berlin Applied Micro Seminar
41. January 2019, Marketing Group, University of Bologna
42. January 2019, Marketing Group, University College, London
43. January 2019, Marketing Group, London Business School
44. November 2018, Marketing Group, HEC Paris, France
45. November 2018, Management Group, Cass Business School, City University of London, UK

46. November 2018, Marketing Group, SOAS University of London
47. November 2018, All Souls College, Oxford
48. November 2018, Economics Group, Paris Telecom
49. October 2018, Marketing Group, University of Amsterdam, Netherlands
50. October 2018, Marketing Group, King's Business School, King's College, London
51. September 2018, Marketing Group, University of Frankfurt, Germany
52. June 2018, Harbin Institute of Technology, China
53. February 2018, IS/OM Group, New York University, NY
54. November 2017, Marketing Group, Rochester University, NY
55. October 2017, Marketing Group, Maryland University, MD
56. May 2017, Marketing Group, Old Dominion University
57. April 2017, Marketing Group, University of Southern California
58. March 2017, Marketing Group, Arison School of Business, IDC, Israel
59. January 2017, Distinguished Speakers Series, McGill University, Canada
60. September 2016, Technology Group, Harvard Business School, MA
61. August 2016, Southern Jiatong University, Sichuan, China
62. May 2016, Chapman University, Marketing Group
63. April 2016, Carnegie Mellon University, Public Policy Group
64. April 2016, Harvard Business School, Entrepreneurial Management Group
65. March 2016, INSEAD, Marketing Group
66. March 2016, University of Paris-Sud, Privacy Research Group
67. March 2016, Vienna University of Economics and Business, Marketing Group
68. September 2015 University of Maryland, IS Group
69. June 2015, Marketing Group, University of Cambridge, UK
70. May 2015, Marketing Group, University of Texas at Dallas, TX
71. March 2015, Health Policy Group, Georgia State University, GA
72. March 2015, Marketing Group, University of Colorado, CO
73. February 2015, Strategy Group, University of North Carolina, NC
74. January 2015, Marketing Group, Emory University, GA
75. December 2014, OPIM, Wharton School of Management, PA
76. October 2014, Economics Department, Yale University, CT
77. September 2014, Marketing Group, Boston University, MA
78. March 2014, Technology Group, University of California at Berkeley, CA
79. January 2014, Marketing Department at Texas A&M
80. November 2013, Marketing Group, University of California at Berkeley, CA
81. October 2013, Marketing Group, Tulane University, LA
82. October 2013, Marketing Group, University of Houston, TX
83. May 2013, Tuck School of Management, Dartmouth University, NH
84. March 2013, Economics Department, University of Toulouse
85. March 2013, Marketing Group, Rotterdam University
86. March 2013, Economics Department, University of Zurich
87. March 2013, Marketing group, Georgia Tech
88. January 2013, Anderson School, UCLA
89. January 2013, Marketing Group, CMU
90. October 2012, Marketing Group, Stanford University

91. October 2012, Marketing Group, Columbia University
92. October 2012, Marketing Group, University of Texas at Austin
93. September 2012, Marketing Group, Harvard Business School
94. June 2012, Strategy Group, London Business School
95. March 2012, Marketing Group, Cornell
96. February 2012, IS Group, Indian School of Business
97. February 2012, Marketing Group, Wharton
98. January 2012, Marketing Group, UCLA
99. November 2011, Marketing Group, University of Rochester
100. October 2011, Marketing Group, University of Zurich
101. October 2011, Department of Law and Economics, Swiss Federal Institute of Technology, Zurich
102. May 2011, Marketing Group, National University of Singapore
103. May 2011, IS Group, National University of Singapore
104. May 2011, Strategy Group, LMU Munich
105. May 2011, Marketing Group, New York University
106. March 2011, Marketing Group, Florida University
107. February 2011, IS Group, New York University
108. November 2010, European School of Management and Technology
109. October 2010, Marketing Group, Yale University
110. October 2010, Networked Business Group, Harvard Business School
111. September 2010, TIES Group, MIT Sloan
112. July 2010, Department of Economics, University of Mannheim
113. March 2010, Marketing Group, Wharton School, University of Pennsylvania
114. January 2010, Marketing Group, University of Michigan
115. November 2009, Marketing Group, University of California at Berkeley
116. October 2009, Digital Business Seminar, MIT Sloan
117. December 2008, Marketing Group, MIT Sloan
118. November 2008, Marketing Group, Rady School of Business, UCSD
119. September 2008, Strategy Group, MIT Sloan
120. May 2008, Digital Strategy Group, Tuck School of Business, Dartmouth University
121. April 2008, Kellogg Management and Strategy Group, Northwestern University
122. March 2008, Marketing Group, Duke University
123. March 2008, Strategy Group, Chicago GSB
124. July 2007, Marketing Group, London Business School, London, UK
125. April 2007, Marketing Group, Chicago GSB
126. March 2007, Marketing Group, Rotman School, University of Toronto
127. November 2005, Economics Department, Harvard University
128. October 2004-February 2005 (Job Market): NYU Stern, University of Michigan, University of Arizona, University of British Columbia, Federal Reserve Board, Federal Reserve Bank of New York, Harvard Business School, Kellogg, MIT Sloan, Federal Reserve Bank of Chicago, Stanford Economics Department

*Other*

129. April 2021, American Enterprise Institute

- 130. June 2020, EE Times- Privacy and Security during Covid-19
  - 131. May 2020, The Digital Economy & The Coronavirus, Bertelsmann Foundation Seminar
  - 132. April 2020, Technology Policy Institute
  - 133. October 2018, Digital Competition Expert Panel, HM Treasury, UK
  - 134. October 2018, Competition and Markets Authority, UK
  - 135. January 2018, IMF
  - 136. December 2017, Technology Policy Institute
  - 137. October 2016, Federal Communications Commission
  - 138. April 2015, Federal Communications Commission
  - 139. November 2014, Office of Research at the Consumer Financial Protection Bureau
  - 140. April 2014, Big Data Working Group, The White House.
  - 141. February 2014, Main Street Patent Coalition, Panel hosted at the Senate by Senator Orrin Hatch
  - 142. July 2013, Federal Communications Commission
  - 143. August 2012, DG Competition, European Commission, Brussels
  - 144. August 2012, Technology Policy Institute Conference, Aspen
  - 145. December 2011, Havas Digital, New York
  - 146. June 2011, Eneca
  - 147. September 2010, Federal Trade Commission
  - 148. September 2010, Google European Public Policy Unit, Paris
  - 149. July 2009, Information Technology and Innovation Foundation, Washington DC
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#### PRESENTATIONS OF RESEARCH AT CONFERENCES

- 1. June 2023, Marketing Science, Miami, FL
- 2. June 2023, Doctoral Consortium, Miami, FL
- 3. April 2023, University College London, Competition Law and Policy in a Data-Driven Economy
- 4. December 2022, Keynote 'Conference on Artificial Intelligence, Machine Learning and Business Analytics, Harvard University'
- 5. May 2022, Keynote 'AI and Analytics for Social Causes' conference, University of Maryland, College Park
- 6. December 2021, Keynote, 4th Research on Innovation, Science and Entrepreneurship Workshop, Max Planck Institute
- 7. November 2021, Keynote, Tokenomics, NYU
- 8. June 2021, Marketing Science
- 9. June 2021, OECD workshop on the Value of Data
- 10. June 2021, Chief Competition Economist ECN working group Annual Meeting
- 11. May 2021, International Finance Corporation, World Bank IFC Digital Jobs
- 12. May 2021, G20 Framework Working Group Seminar on Data Access and Availability
- 13. May 2021, Data and innovation: solutions and business models in the digital economy (Brazil)
- 14. March 2021, Digital Economics Seminar, Digital Tutorial

15. December 2020, Digital Economics Research Network Conference
16. December 2020, Conference on Artificial Intelligence, Machine Learning, and Business Analytics
17. December 2020, Health Systems Innovation Advisory Board Meeting
18. November 2020, 2nd Luohan Academy Frontier Dialogue - Platform Economy and Market Dynamics
19. October 2020, Policy Toolkit for a Better Europe, European Commission
20. September 2020, ICN Annual conference
21. June 2020, Marketing Science
22. June 2020, International Competition Network, ‘Competition law enforcement at the intersection of Competition, Consumer Protection, and Privacy’
23. November 2019, ABA Fall Forum: The Tech Summit, Washington DC.
24. November 2019, Annual Challenges to Antitrust in a Changing Economy, Harvard Law School
25. October 2019, World Bank Platforms Summit, Washington DC.
26. September 2019, Economics of AI Doctoral Consortium, Toronto
27. July 2019, Quantitative Marketing and Structural Econometrics Workshop, Northwestern University
28. June 2019, Marketing Science, Rome
29. June 2019, Keynote Speaker, ZEW Conference on the Economics of Information and Communication Technologies, Mannheim
30. June 2019 Keynote Speaker, Munich Summer Institute, Munich
31. May 2019, Keynote Speaker, 3rd Doctoral Workshop on the Economics of Digitization, Brussels
32. November 2019, FTC Hearings on Big Data, Privacy, and Competition
33. October 2019, FTC Hearings on Platform Economics, George Mason University
34. June 2018, Antitrust and Big Data, Penn Wharton China Center Conference, Beijing
35. June 2018, Marketing Science
36. May 2018, Boston College Digital Innovation Workshop
37. December 2017, Mobile Marketing and Big Data Conference, NYU
38. September 2017, NBER Economics of AI Conference
39. July 2017, BU Platforms Conference
40. July 2017, NBER Digitization Meetings
41. June 2017, Marketing Science
42. June 2017, Regulation of Algorithms, Berlin
43. May 2017, Boston College Digital Innovation Workshop
44. November 2016, ICANN Public Meetings
45. October 2016, Conference on Digital Experimentation, Cambridge, MA
46. September 2016, FTC Consumer Protection Conference, Washington, DC
47. September 2016, George Washington roundtable on Platforms, Washington DC
48. May 2016, Competing with Big Data, Brugel, Brussels, Belgium
49. April 2016, NBER Innovation and Policy, Washington DC
50. April 2016, Financial Services Roundtable, NYC
51. March 2016, Digitization Tutorial, NBER
52. January 2016, PrivacyCon, FTC Conference, Washington, DC

53. July 2015, NBER Law and Economics (co-author presented), Cambridge, MA
54. July 2015, NBER Economics of Digitization, Cambridge, MA
55. June 2015, 'The Future of Research in the Digital Society', French Ministry of Culture and Communication - Toulouse School of Economics, Paris, France
56. June 2015, Marketing Science, Baltimore, MD
57. June 2015, Doctoral Consortium, Baltimore, MD
58. March 2015, IP Leadership Conference, Washington, DC
59. February 2015, Patents in Theory and Practice, Washington, DC
60. June 2014, Marketing Science, Atlanta, GA
61. May 2014, Boston College Social Media Workshop, Boston, MA
62. January 2014, American Economic Association Meetings
63. July 2013, Marketing Science, Istanbul, Turkey
64. June 2013, Searle Center Conference on Internet Search and Innovation, Chicago, IL
65. April 2013, Brown University Mini-Networks Conference
66. February 2013, WSDM 2013 Conference (Keynote Speaker), Rome, Italy
67. January 2013, American Economic Association Meetings, San Diego, CA (Co-author presented)
68. December 2012, New York Computer Science and Economics Day
69. November 2012, Search and Competition Conference, Melbourne Australia
70. October 2012, Economics of Personal Data, (Keynote Speaker), Amsterdam
71. August 2012, Amsterdam Symposium on Behavioral and Experimental Economics
72. July 2012, Fudan University Marketing Research Symposium, China
73. June 2012, Searle Center Conference on Internet Search and Innovation, Chicago, IL
74. June 2012, Innovation, Intellectual Property and Competition Policy Conference, Tilburg, Netherlands
75. June 2012, Marketing Science, Boston, MA
76. June 2012, Social Media and Business Transformation, Baltimore, MD
77. May 2012, The Law and Economics of Search Engines and Online Advertising, George Mason University, Arlington, VA
78. February 2012, NBER Economics of Digitization (co-author presented), Cambridge, MA
79. January 2012, Symposium on Antitrust and High-Tech Industries, George Mason University, VA
80. January 2012, Patents, Standards and Innovation, Tucson, AZ
81. January 2012, Econometric Society Meetings, Chicago, IL
82. January 2012, AEA Meetings (2 papers), Chicago, IL
83. December 2011, Economics of Privacy Workshop, Boulder, CO
84. November 2011, Economics and Computation Day, Cambridge, MA
85. November 2011, HBS Strategy Research Conference, Boston, MA
86. November 2011, The Law and Economics of Internet Search and Online Advertising Roundtable, George Mason University, Arlington, VA
87. November 2011, Patents Statistics for Decision Makers, Alexandria, VA
88. October 2011, Workshop on Health IT and Economics, Washington, DC
89. October 2011, Innovation, Organizations and Society, University of Chicago, IL
90. October 2011, Direct Marketing Research Summit, Boston, MA
91. September 2011, Invited Session 'Economics and Marketing', EARIE, Stockholm, Sweden.

92. July 2011, NBER Economics of Digitization, Cambridge, MA
93. July 2011, SICS, Berkeley, CA
94. June 2011, The Law and Economics of Search Engines and Online Advertising, George Mason University, Arlington, VA
95. June 2011, Workshop on the Economics on Information Security, Washington, DC
96. June 2011, Marketing Science (3 papers), Houston, TX
97. June 2011, Searle Center Conference on Internet Search and Innovation, Chicago, IL
98. May 2011, Boston College Social Media Workshop, Boston, MA
99. May 2011, Technology Pricing Forum, Boston, MA
100. April 2011, NBER Innovation Policy and the Economy, Washington, DC
101. April 2011, International Industrial Organization Conference (3 papers), Boston, MA
102. March 2011, Technology Policy Institute, Washington, DC
103. February 2011, NBER Economics of Digitization (co-author presented), Palo Alto, CA
104. January 2011, Sixth bi-annual Conference on The Economics of Intellectual Property, Software and the Internet (2 papers, plenary speaker), Toulouse, France
105. January 2011, MSI Young Scholars Conference, Park City, UT
106. December 2010, Workshop on Information Systems and Economics, Washington University of St. Louis (co-author presented), St. Louis, MO
107. December 2010, OECD Economics of Privacy Roundtable, Paris, France
108. November 2010, Net Institute Conference, New York, NY
109. October 2010, Workshop on Media Economics and Public Policy (co-author presented), New York, NY
110. October 2010, Workshop on Health IT and Economics, Washington, DC
111. September 2010, ITIF and CAGW Privacy Working Group Meetings, Washington, DC
112. September 2010, Medical Malpractice Conference, Mohegan, CT
113. September 2010, Search and Web Advertising Strategies and Their Impacts on Consumer Workshop, Paris, France
114. July 2010, NBER Meetings (IT), Cambridge, MA
115. July 2010, NBER Meetings (Healthcare and IT), Cambridge, MA
116. July 2010, SICS, Berkeley, CA
117. July 2010, Keynote Speaker, 8th ZEW Conference on the Economics of Information and Communication Technologies, Mannheim, Germany
118. June 2010, American Society of Health Economists Conference, Cornell, NY
119. June 2010, Marketing Science (2 papers), Koeln, Germany
120. June 2010, Workshop on the Economics of Information Security (2 papers), Harvard, MA
121. January 2010, AEA Meetings, Atlanta, GA
122. December 2009, Workshop on Information Systems and Economics, Scottsdale, AZ
123. November 2009, WPP/Google Marketing Awards, Cambridge, MA
124. July 2009, NBER meetings (IT), Cambridge, MA
125. June 2009, IHIF Debate on Privacy, Washington, DC
126. June 2009, Marketing Science, Ann Arbor, MI
127. April 2009, International Industrial Organization Conference, Boston, MA
128. January 2009, Information Security Best Practices Conference, Philadelphia, PA
129. January 2009, Modeling Social Network Data Conference, Philadelphia, PA
130. July 2008, NBER Meetings (Productivity), Cambridge, MA

131. July 2008, SICS, Berkeley, CA
  132. July 2008, Fourth Workshop on Ad Auctions, Chicago, MA
  133. June 2008, Marketing Science, Vancouver, BC
  134. May 2008, International Industrial Organization Conference, Richmond, VA
  135. April 2008, Net Institute Conference, New York, NY
  136. November 2007, NBER Health Meetings (Co-author presented), Boston, MA
  137. July 2007, SICS, Berkeley, CA
  138. June 2007, Workshop on the Economics of Information Security, Pittsburgh
  139. June 2007, Choice Symposium, Philadelphia, PA
  140. May 2007, eCommerce Research Symposium, Stamford, CT
  141. April 2007, Net Institute Conference, New York, NY
  142. April 2007, International Industrial Organization Conference, Savannah, GA
  143. March 2007, Health Economics Conference, Tucson, AZ
  144. February 2007, NBER Winter Meetings, Palo Alto, CA
  145. January 2007, Economics of the Software and Internet Industries (2 Papers), Toulouse, France
  146. October 2006, QME Conference, Stanford University, CA
  147. June 2006, Marketing Science, Pittsburgh, PA
  148. April 2006, International Industrial Organization Conference, Boston, MA
  149. October 2005, NEMC Conference, Boston, MA
  150. October 2005, TPRC Conference, Washington, DC
  151. June 2005, CRES Industrial Organization Conference, Washington University in St. Louis, MO
  152. July 2002, Payment Systems Conference, IDEI, Toulouse, France
- 

#### PROFESSIONAL SERVICE

- Senior Editor, Marketing Science
- Director of the program on the Economics of Digitization at The National Bureau of Economic Research.
- Co-Director of the program on the Artificial Intelligence at The National Bureau of Economic Research.
- **Vice President (Education)**, ISMS 2019-2021
- **Associate Editor:** Management Science, Marketing Science, Journal of Marketing Research, International Journal of Research in Marketing
- **Associate Editor:** Information Systems Research, Special Issue on Social Media and Business Transformation
- **Departmental Editor:** Quantitative Marketing and Economics
- **Editor:** The Economics of the Internet, Palgrave Dictionary of Economics
- **Co-Editor:** NBER: The Economics of Digitization - An Agenda
- **Co-Editor:** Information Economics and Policy, Special Issue on Economics of Digital Media Markets
- **Editorial Review Board:** Journal of Marketing, ISR Special Issue on Managing Digital Vulnerabilities, Journal of Economic Literature

- **Conference Program Committees**

- 2022 Co-organizer, NBER Conference on Digital Economics
- 2022 Co-organizer, NBER Conference on the Economics of Artificial Intelligence
- 2021 Co-organizer, NBER Conference on Digital Economics
- 2021 Co-organizer, NBER Conference on the Economics of Artificial Intelligence
- 2020 Co-organizer, NBER Conference on the Economics of Artificial Intelligence
- 2020 Organizer, ISMS Doctoral Consortium
- 2019 Co-organizer, NBER Conference on the Economics of Artificial Intelligence
- 2019 Scientific Committee: ZEW Conference on the Economics of Information and Communication Technologies
- 2019 Program Committee: Workshop on the Economics of Information Security
- 2019 Scientific Committee: IP Statistics for Decision Makers
- 2018 Co-organizer, NBER Conference on the Economics of Artificial Intelligence
- 2017 Scientific Committee: IP Statistics for Decision Makers
- 2017 Scientific Committee: ZEW Conference on the Economics of Information and Communication Technologies
- 2017 Program Committee: Workshop on the Economics of Information Security
- 2016 Program Committee: Workshop on the Economics of Information Security
- 2016 Scientific Committee: ZEW Conference on the Economics of Information and Communication Technologies
- 2015 Scientific Committee: Competition, Standardization and Innovation
- 2015 Scientific Committee: Intellectual Property Statistics for Decision Makers
- 2015 Associate Editor: ICIS 2015, Healthcare track
- 2015 Scientific Committee: European Association for Research in Industrial Economics
- 2015 Program Committee: ACM Conference on Economics and Computation
- 2015 Program Committee: Workshop on the Economics of Information Security
- 2015 Chief-Organizer: Quantitative Marketing and Economics Conference
- 2015 Scientific Committee: ZEW Conference on the Economics of Information and Communication Technologies
- 2014 Scientific Committee: European Association for Research in Industrial Economics
- 2014 Scientific Committee: Conference on the Economics of Information and Communication Technologies
- 2014 Program Committee: International Conference on Big Data and Analytics in Healthcare
- 2013 Program Committee: Quantitative Marketing and Economics
- 2013 Scientific Committee: European Association for Research in Industrial Economics Conference
- 2013 Scientific Committee: Conference on the Economics of Information and Communication Technologies
- 2013 Program Committee: Workshop on the Economics of Information Security
- 2013 Associate Editor of Personal Data Markets Track: ECIS 2013
- 2012 Program Committee: European Association for Research in Industrial Economics Conference
- 2012 Program Committee (Conference Organizer) NBER: The Economics of Digitization Pre-Conference, June 2012

- 2012 Scientific Committee: Conference on the Economics of Information and Communication Technologies
- 2012 Senior Program Committee: 13th ACM Conference on Electronic Commerce
- 2012 Program Committee: Workshop on the Economics of Information Security
- 2011 Scientific Committee: European Association for Research in Industrial Economics Conference
- 2011 Scientific Committee: Conference on the Economics of Information and Communication Technologies
- 2011 Program Committee: Ad Auctions Workshop
- 2011 Program Committee: Workshop on the Economics of Information Security
- 2010 Program Committee: Workshop on IT and Economic Growth
- 2010 Program Committee: Conference on Health IT and Economics
- 2010 Program Committee: Workshop on the Economics of Information Security
- 2009 Program Committee: Workshop on the Economics of Information Security
- 2008 Program Committee: Workshop on the Economics of Information Security
- 2008 Program Committee: Ad Auctions Workshop

#### **External Affiliations**

- **Affiliate:** CESifo Research Network
  - **Advisory Board:** Future of Privacy Forum
  - **Advisory Board:** Academic Advisory Counsel, Brookings Center on Regulation and Markets
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#### MIT SERVICE

- 2015- Faculty Chair, PhD program
  - 2015- EMBA Committee
  - 2015- ASB Committee
  - 2014- MIT Sloan Gender Equity Committee
  - 2013-2014 Group Head, Marketing Group
  - 2013-2014 Chair, Marketing Faculty Search Committee
  - 2013-2014 MIT Committee on Undergraduate Admissions and Financial Aid
  - 2011 North East Marketing Conference Coordinator
  - 2011 MIT Sloan Marketing Conference, Panel Moderator
  - 2011 Sloan Women in Management Conference, Panel Moderator
  - 2005, 2008, 2012 Marketing Faculty Search Committee
- 

#### ADVISING

- 2019: Shuyi Yu, PhD Thesis supervisor
- 2016: Abhishek Nagaraj, PhD Thesis advisor
- 2012: Cristina Nistor, PhD Thesis advisor
- 2010: Katherine Molina, Masters Thesis

- 2008: Dinesh Shenoy, Masters Thesis
  - 2007: James Kelm, Masters Thesis
- 

## GRANTS AND SUPPORT

### *Academic Grants*

2018	Sloan Foundation Grant (2018-2021), 'NBER Project on the Economics of Artificial Intelligence' - Grant supporting series of NBER Economics of AI Conferences. (Joint with Ajay Agrawal, Joshua Gans and Avi Goldfarb)	\$914,250
2017	Net Institute Grant (Joint with Anuj Kapoor)	\$3,000
2016	Net Institute Grant (Joint with Christian Catalini)	\$6,000
2013	MSI research Grant 4-1840 (Joint with Anja Lembrecht)	\$10,200
2011	Tilburg Law and Economics Center (TILEC) IIPC grant	\$21,000
2011	Google Grant	\$50,000
2011	Junior Faculty Research Assistance Program	\$30,000
2011	Net Institute Grant	\$6,000
2011	NBER Digitization Grant	\$20,000
2011	NSF CAREER Award	\$502,000
2010	Time-Warner Research Program on Digital Communications	\$20,000
2010	Net Institute Grant	\$6,000
2009	Net Institute Grant	\$6,000
2009	The James H. Ferry, Jr. Fund for Innovation in Research Education	\$50,000
2009	Google/WPP Grant (Joint with Avi Goldfarb)	\$55,000
2008	Net Institute Grant	\$15,000
2007	Net Institute Grant	\$8,000
2006	Net Institute Grant (Joint with Stephen Ryan)	\$8,000

### *Industry Research Grants*

2015	CCIA Research: Research into Sustainable Competitive Advantage and Big Data (Joint with Anja Lembrecht)	\$60,000
2015	E-Logic: Research into Vertical Mergers and Patent Litigation	\$60,000
2014	CCIA Research: Research into Patent Litigation and Entrepreneurship	\$100,000
2012	Google Australia: Research into Measurement and Attribution	\$50,000

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## EXPERT TESTIMONY

- I have provided expert testimony for Accenture, Atlantic Recording Company, ADT, Bausch Health, Broadcast Music Inc, Capitol Records, Context Logic, Facebook, Google,

IAC, Lyft, Marriott, Match Group, Microsoft, Plaintiffs in Blue Cross Blue Shield Antitrust Litigation , Revizer, Reynolds Automotive, RDIC, Samsung, Sony, Sound Exchange, Verizon (Yahoo and AOL), United Health Group, US Debtors (Nortel Bankruptcy Proceedings), Walworth Investments and Warner Brothers.

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## TEACHING

- 15.818, Pricing (MBA Elective) 2006-
- 15.732, Marketing Management for Senior Executives 2012-
- 15.726, Pricing (EMBA Elective) 2012-
- 15.838, Doctoral Seminar, Spring 2006, Fall 2007, Fall 2013
- Marketing Management, Asian School of Business, 2016
- Guest Lecturer: HST.936: Health information systems to improve quality of care in resource-poor settings, 2014
- Executive Education: Blockchain Technologies: Business Innovation and Application, 2018-
- Executive Education: Marketing Innovation, 2016-
- Executive Education: Pricing 4dX, 2016-
- Executive Education: Strategic Marketing for the Technical Executive, 2012-2015
- Executive Education: Systematic Innovation of Products, Processes, and Services, 2013-
- Executive Education: Platform Strategy: Building and Thriving in a Vibrant Ecosystem, 2014-
- Executive Education: Global Executive Academy (multi-language), 2013, 2014
- Executive Education: Entrepreneurship Development Program, 2012-
- Faculty Coach, Takeda Leadership Academy, 2016-18

**APPENDIX B – PRIOR TESTIMONY**

1. In Re: Lyft Rideshare Cases, Case No. CJC-20-005061, Superior Court of the State of California County of San Francisco. Deposition (2023)
2. In Re: Google Play Store Antitrust Litigation, MDL No.: 3:21-md-2981, United States District Court for the Northern District of California. Deposition (2023)
3. United States of America et al. v. United Health Group Incorporated et al., Case No. 1:22-cv-00481, In the United States District Court for the District of Columbia Court. Deposition and Trial (2022).
4. United States of America, et al., v. Google LLC, Case No.: 1:20-cv-03010-APM, and State of Colorado, et al., v. Google LLC, Case No.: 1:20-cv-03715-APM, In the United States District Court for the District of Columbia. Deposition (2022).
5. Atlantic Recording Corporation, Laface Records LLC, Sony Music Entertainment, UMG Recordings, Inc., Warner Bros. Records Inc., Arista Music, Arista Records LLC, Bad Boy Records LLC, Capitol Records, LLC, Elektra Entertainment Group Inc., Roc-A-Fella Records, LLC, Sony Music Entertainment US Latin LLC, Zomba Recording LLC, v. Spinrilla, LLC and Jeffery Dylan Copeland, Civil Action No. 1:17-cv-00431, United States District Court for the Northern District of Georgia Atlanta Division. Deposition (2022).
6. Broadcast Music, Inc. v. North American Concert Promoters Association., 18 Civ. 8749, Related to United States v. Broadcast Music, Inc., 64 Civ. 3787, United States District Court Southern District of New York. Deposition and Trial (2022).
7. In Re: Marriott International Customer Data Breach Litigation, MDL No.: 19-md-2879, United States District Court for the District of Maryland. Deposition (2021) and Hearing (2022).
8. Cox Automotive, Inc.; Autotrader.com, Inc.; Dealer Dot Com, Inc.; Dealertrack, Inc.; Homenet, Inc.; Kelley Blue Book Co., Inc.; Vauto, Inc.; Vinsolutions, Inc.; and Xtime, Inc., v. The Reynolds and Reynolds Company, AAA Case No. 01-19-0000-4548, American Arbitration Association. Deposition (2021).
9. dotStrategy, Co., Individually and On Behalf of All Other Similarly Situated, v. Facebook, Inc., Case No. 20-cv-00170-WHA, United States District Court for the Northern District of California. Deposition (2021).
10. Deborah Louise Douez, v. Facebook, Inc., Case No. VLC-S-S-122316, Supreme Court of British Columbia, Vancouver Registry. Cross Examination (2021).
11. Sean Rad, Plaintiff/Counterclaim-Defendant, Paul Cafardo, Gareth Johnson, Alexa Mateen, Justin Mateen, and Ryan Ogle, Plaintiffs, v. IAC/InteractiveCorp, Match Group, Inc., and Match Group, LLC, Defendants/Counterclaim-Plaintiffs. Index No. 654038/2018, Supreme

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Court of the State of New York, County of New York. Deposition and Trial (2021).

12. TravelPass Group, LLC, Partner Fusion, Inc., Reservation Counter, LLC, v. Caesars Entertainment Corporation, Choice Hotels International, Inc., Hilton Domestic Operating Company Inc., Hyatt Hotels Corporation, Marriott International, Inc., Red Roof Inns, Inc., Six Continents Hotels, Inc., Wyndham Hotel Group, LLC., Case No. 5:18-cv-152-RWS-CMC, United States District Court, Eastern District of Texas, Texarkana Division. Deposition and Trial (2021).
13. DZ Reserve, and Cain Maxwell (d/b/a Max Martialis) individually and on behalf of others similarly situated v. Facebook, Inc., Case No. 3:18-cv-04978, United States District Court, Northern District of California. Deposition (2021).
14. Integritymessageboard.com. LLC, v. Facebook, Inc., Case No. 4:18-cv-05286-PJH, United States District Court, Northern District of California. Deposition (2021).
15. In re: Blue Cross Blue Shield Antitrust Litigation (MDL No. 2406), Master File No. 2:13-CV-20000-RDP, United States District Court, Northern District of Alabama, Southern Division. Deposition (2021).
16. In Re: Glumetza Antitrust Litigation, Case No. 3:19-cv-05822-WHA, United States District Court for the Northern District of California. Deposition (2020).
17. In re Determination of Rates and Terms for Digital Performance of Sound Recordings and Making of Ephemeral Copies to Facilitate those Performances (Web V), Case No. 19-CRB-0005-WR (2021-2025), United States Copyright Royalty Judges, Washington, D.C. Deposition and Hearing (2020).
18. Stephen Adkins, et al., v. Facebook, Inc., Case No. 18-CV-05982-WHA, United States District Court, Northern District of California. Deposition (2019).
19. DealDash OYJ and DealDash Inc, Plaintiffs vs, Contextlogic Inc. d/b/a Wish, Defendant, Case No. 18-cv-02353-MMC, District Court of Northern California. Deposition (2019).
20. In Re Disposable Contact Lens Antitrust Litigation. No. 3:15-md-2626-J-20JRK United States District Court, Middle District of Florida, Jacksonville Division. Deposition (2018, 2020).

## APPENDIX C – MATERIALS CONSIDERED

### **Legal Documents**

Expert Report of DeJongh “Dee” Wells, *Nike Inc. v. StockX LLC*, 1:22-cv-000983-VEC, May 5, 2023.

First Amended Complaint, *Nike, Inc. v. StockX LLC*, No. 1:22-cv-000983-VEC, May 25, 2022.

### **Bates-Stamped Documents**

StockX, “Customer Research: Innovation Survey Report,” July 13, 2021, STX0026540-578.

StockX, “Email From Shervin Moghaddam to Scutt Cutler and Yasir Malik,” January 20, 2022, STX0039795-801.

StockX, “Email From Yasir Malik to Greg Schwartz and Jacob Fenton,” January 19, 2022, STX0102190-195.

StockX, “Physical Data,” STX0806026.

StockX, “StockX Trading,” May 27, 2021, STX0039521-584.

StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216.

StockX, “Vault NFT Data,” STX0806025.

### **Academic Papers**

Abreu, Dilip, and Markus Brunnermeier, “Bubbles and Crashes,” *Econometrica*, Vol. 71, No. 1, 2003, pp. 173-204.

Akerlof, George, “The Market for ‘Lemons’: Quality Uncertainty and the Market Mechanism,” *The Quarterly Journal of Economics*, Vol. 84, No. 3, 1970, pp. 488-500.

Almeida, José, and Tiago Cruz Gonçalves, “A Systematic Literature Review of Investor Behavior in the Cryptocurrency Markets,” *Journal of Behavioral and Experimental Finance*, Vol. 37, 2023, pp. 1-18.

Athey, Susan, Christian Catalini, and Catherine Tucker, “The Digital Privacy Paradox: Small Money, Small Costs, Small Talk,” *NBER Working Paper 23488*, 2017, pp. 1-26.

Bakos, Yannis, and Hanna Halaburda, “The Role of Cryptographic Tokens and ICOs in Fostering Platform Adoption,” *Social Science Research Network*, 2019, pp. 1-40.

Bleier, Alexander, Avi Goldfarb, and Catherine Tucker, “Consumer Privacy and the Future of Data-Based Innovation and Marketing,” *International Journal of Research in Marketing*, Vol. 37, No. 3, 2020, pp. 466-480.

boyd, danah, and Nicole Ellison, “Social Network Sites: Definition, History, and Scholarship,” *Journal of Computer-Mediated Communication*, Vol. 13, No. 1, 2008, pp. 210-230.

Brunnermeier, Markus, and Stefan Nagel, “Hedge Funds and the Technology Bubble,” *The Journal of Finance*, Vol. 59, No. 5, 2004, pp. 2013-2040.

Caginalp, Gunduz, David Porter, and Vernon Smith, “Overreaction, Momentum, Liquidity, and Price Bubbles in Laboratory and Field Asset Markets,” *Journal of Psychology and Financial Markets*, Vol. 1, 2000, pp. 24-48.

Catalini, Christian, and Joshua Gans, “Initial Coin Offerings and Value of Crypto Tokens,” *Social Science Research Network*, 2019, pp. 1-37.

- Catalini, Christian, and Catherine Tucker, “Antitrust and Costless Verification: an Optimist and a Pessimistic View of the Implications of Blockchain Technology,” *Antitrust Law Journal*, Vol. 82, No. 3, 2019, pp. 861-872.
- Catalini, Christian, and Catherine Tucker, “Seeding the S-Curve? The Role of Early Adopters in Diffusion,” *NBER Working Paper 22596*, 2016, pp. 1-32.
- Catalini, Christian, and Catherine Tucker, “When Early Adopters Don’t Adopt,” *Science*, Vol. 357, No. 6347, 2017, pp. 135-136.
- Cong, Lin William, Xiang Hui, Catherine Tuker, and Luofeng Zhou, “Scaling Smart Contracts Via Layer-2 Technologies: Some Empirical Evidence,” *NBER Working Paper 30912*, 2023, pp. 1-20.
- Conley, John, “Blockchain and the Economics of Crypto-tokens and Initial Coin Offerings,” *Vanderbilt University Department of Economics Working Papers*, 2017, pp. 1-18.
- Cui, Tony Haitao, Anindya Ghose, Hanna Halaburda, Raghuram Iyengar, Koen Pauwels, S. Sriram, Catherine Tucker, and Sriraman Venkataraman, “Informational Challenges in Omnichannel Marketing: Remedies and Future Research,” *Journal of Marketing*, Vol. 85, No. 1, 2021, pp. 103-120.
- Evans, David, “The Antitrust Economics of Multi-Sided Platform Markets,” *Yale Journal on Regulation*, Vol. 20, 2003, pp. 325-381.
- Evans, David, and Michael Noel, “Defining Markets that Involve Multi-sided Platform Businesses: An Empirical Framework with an Application to Google’s Purchase of DoubleClick,” *Working Paper*, No. 07-18, 2007, pp. 1-47.
- Fradkin, Andrey, Elena Grewal, David Holtz, and Matthew Pearson, “Bias and Reciprocity in Online Reviews: Evidence From Field Experiments on Airbnb” presented at EC ’15: Proceedings of the Sixteenth ACM Conference on Economics and Computation (Cambridge, MA, July 15, 2015).
- Goldfarb, Avi, and Catherine Tucker, “Digital Economics,” *Journal of Economic Literature*, Vol. 57, No. 1, 2019, pp. 3-43.
- Hagiu, Andrei, “Multi-sided Platforms: From Microfoundations to Design and Expansion Strategies,” *Working Paper*, No. 09-115, 2008, pp. 1-25.
- Howell, Sabrina, Marina Niessner, and David Yermack, “Initial Coin Offerings: Financing Growth With Cryptocurrency Token Sales,” *NBER Working Paper 24774*, 2019, pp. 1-64.
- Julien, Bruno, Alessandro Pavan, and Marc Rysman, “Two-Sided Markets, Pricing, and Network Effects,” *Social Science Research Network*, 2021, pp. 1-100.
- Klein, Tobias J., Christian Lambertz, and Konrad O. Stahl, “Market Transparency, Adverse Selection, and Moral Hazard,” *Journal of Political Economy*, Vol. 124, No. 6, 2016, pp. 1677-1713.
- Lei, Vivian, Charles Noussair, and Charles Plott, “Nonspeculative Bubbles in Experimental Asset Markets: Lack of Common Knowledge of Rationality vs. Actual Irrationality,” *Econometrica*, Vol. 69, No. 4, 2001, pp. 831-859.
- Lendle, Andreas, Marcelo Olarreaga, Simon Schropp, and Pierre-Louis Vézina, “There Goes Gravity: eBay and the Death of Distance,” *The Economic Journal*, Vol. 126, No. 591, 2016, pp. 406-441.
- Maouchi, Youcef, Lanouar Charfeddine, and Ghassen El Montasser, “Understanding Digital Bubbles Amidst the COVID-19 Pandemic: Evidence from DeFi and NFTs,” *Finance Research Letters*, Vol. 47, 2022, pp. 1-8.

- Marthews, Alex, and Catherine Tucker, “What Blockchain Can and Can’t Do: Applications to Marketing and Privacy,” *International Journal of Research in Marketing*, Vol. 40, No. 1, 2023, pp. 49-53.
- Nosko, Chris, and Steven Tadelis, “The Limits of Reputation in Platform Markets: An Empirical Analysis and Field Experiment,” *NBER Working Paper 20830*, 2015, pp. 1-36.
- Plangger, Kirk, Dhruv Grewal, Ko De Ruyter, and Catherine Tucker, “The Future of Digital Technologies in Marketing: A conceptual Framework and an Overview,” *Journal of the Academy of Marketing Science*, Vol. 50, No. 6, 2022, pp. 1125-1134.
- Sharma, Akshita, Jatin Gupta, Lovika Gera, Mehul Sati, and Shikha Sharma, “Relationship between customer satisfaction and loyalty,” *Social Science Research Network*, 2020.
- Sorescu, Alina, Sorin M. Sorescu, Will J. Armstrong, and Bart Devoldere, “Two Centuries of Innovations and Stock Market Bubbles,” *Marketing Science*, Vol. 37, No. 4, 2018, pp. 507-529.
- Tadelis, Steven, “Reputation and Feedback Systems in Online Platform Markets,” *NBER Working Paper*, 2016, pp. 1-33.
- Temin, Peter, and Hans-Joachim Voth, “Riding the South Sea Bubble,” *American Economic Review*, Vol. 94, No. 5, 2004, pp. 1654-1668.
- Tucker, Catherine, “Digital Infrastructure: Does the ‘Coring’ of Digital Platforms Make Them Part of Digital Infrastructure?,” *Working Paper*, 2020, pp. 1-7.
- Tucker, Catherine, “How Platforms Create Value Through Coring and Implications for Market Definition,” *CPI Antitrust Chronicle*, Vol. 2, No. 2, 2022, pp. 16-19.
- Tucker, Catherine, “Identifying Formal and Informal Influence in Technology Adoption with Network Externalities,” *Management Science*, Vol. 54, No. 12, 2008, pp. 2024-2038.

## Books

- Belleflamme, Paul, and Nicolas Neysen, *Platform Strategies: A Guidebook for Entrepreneurs in the Platform Economy*, London, Routledge, 2023.
- Belleflamme, Paul, and Martin Peitz, *The Economics of Platforms*, Cambridge, UK, Cambridge University Press, 2021.
- Evans, David, and Richard Schmalensee, *Matchmakers: The New Economics of Multisided Platforms*, Boston, Harvard Business Review Press, 2016.
- Evans, David, and Richard Schmalensee, *Paying with Plastic: The Digital Revolution in Buying and Borrowing* 2 Ed., Cambridge, MA, The MIT Press, 2005.
- Goldfarb, Brent, and David Kirsch, *Bubbles and Crashes: The Boom and Bust of Technological Innovation*, Stanford, CA, Stanford University Press, 2019.
- Harvard Business Review, *Blockchain: The Insights You Need from Harvard Business Review*, Cambridge, MA, Harvard Business Review Press, 2019.
- Marthews, Alex, and Catherine Tucker, “Blockchain and Identity Persistence,” *Cryptoassets: Legal, Regulatory, and Monetary Perspectives*, edited by Chris Brummer, Oxford, UK, Oxford University Press, 2019.
- Parker, Geoffrey G., Marshall W. Van Alstyne, and Sangeet Paul Choudary, *Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You*, W. W. Norton & Company, 2016.
- Shiller, Robert, *Irrational Exuberance* 3rd Ed., Princeton, NJ, Princeton University Press, 2016.

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## APPENDIX D – ADDITIONAL DATA ANALYSES

### Exhibit D1: Summary Statistics of Vault NFT Releases<sup>212</sup>

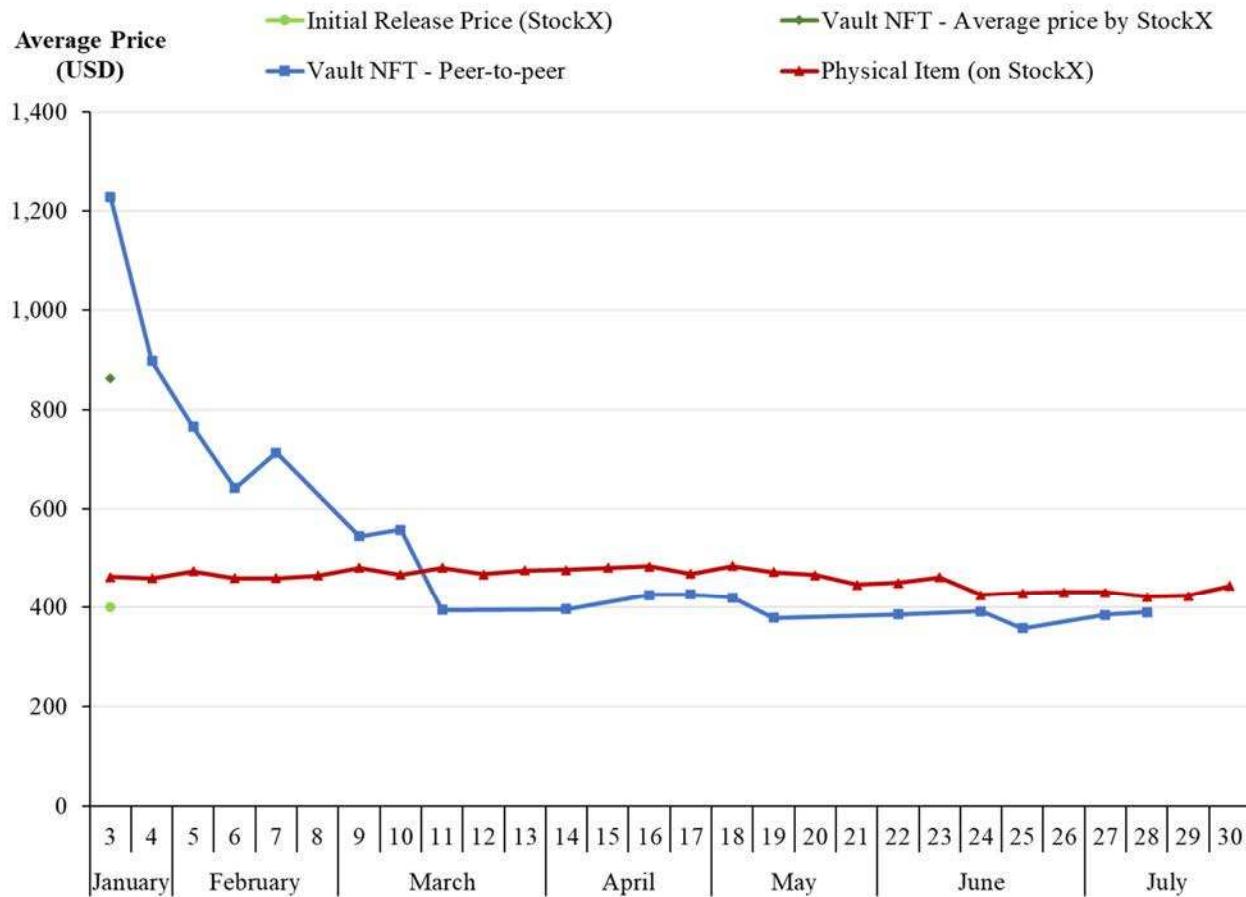
Model of Corresponding Nike Shoe	Initial Release Price	Manufacturer's Suggested Retail Price	Average Price on Release Date		Total Number of Released Vault NFTs	
			StockX	P2P	Initial Release Price	Market Price
Air Jordan 1 Retro High OG Bred Patent	\$300	\$170	-	\$756	191	17
Air Jordan 4 Retro White Oreo 2021	\$400	\$190	\$1,316	\$1,497	49	51
Nike Dunk Low Retro White Black 2021	\$220	\$110	\$1,319	\$1,631	52	48
Nike Blazer Low sacai KAWS Blue	\$120	\$140	\$1,002	\$1,182	54	46
Nike SB Dunk Low Ben Jerrys Chunky Dunky	\$1,250	\$100	-	-	2	1
Nike Air VaporMax 2019 CPFM	\$600	\$250	\$2,050	-	2	1
Air Jordan 3 Retro A Ma Maniere W	\$450	\$200	-	\$2,900	1	0
Nike Dunk Low Off' White Lot 50	\$750	\$180	\$5,000	-	0	1

**Note:** Each Vault NFT model was first released on January 18, 2022, except for the Air Jordan 1, which was first released on January 26, 2022. The initial release price for Vault NFTs linked to the Air Jordan 1 sneakers is inferred based on their uniform price of \$300 sold by StockX on the day of release. Due to the bug affecting StockX’s ability to release all Vault NFTs at the intended initial release price, some Vault NFTs were released at market prices. The number of releases is recorded in the first two columns. The average price on the release date for StockX covers any releases that were not released at the initial release price, but at market prices.

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<sup>212</sup> StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026. See also StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216 (providing release prices).

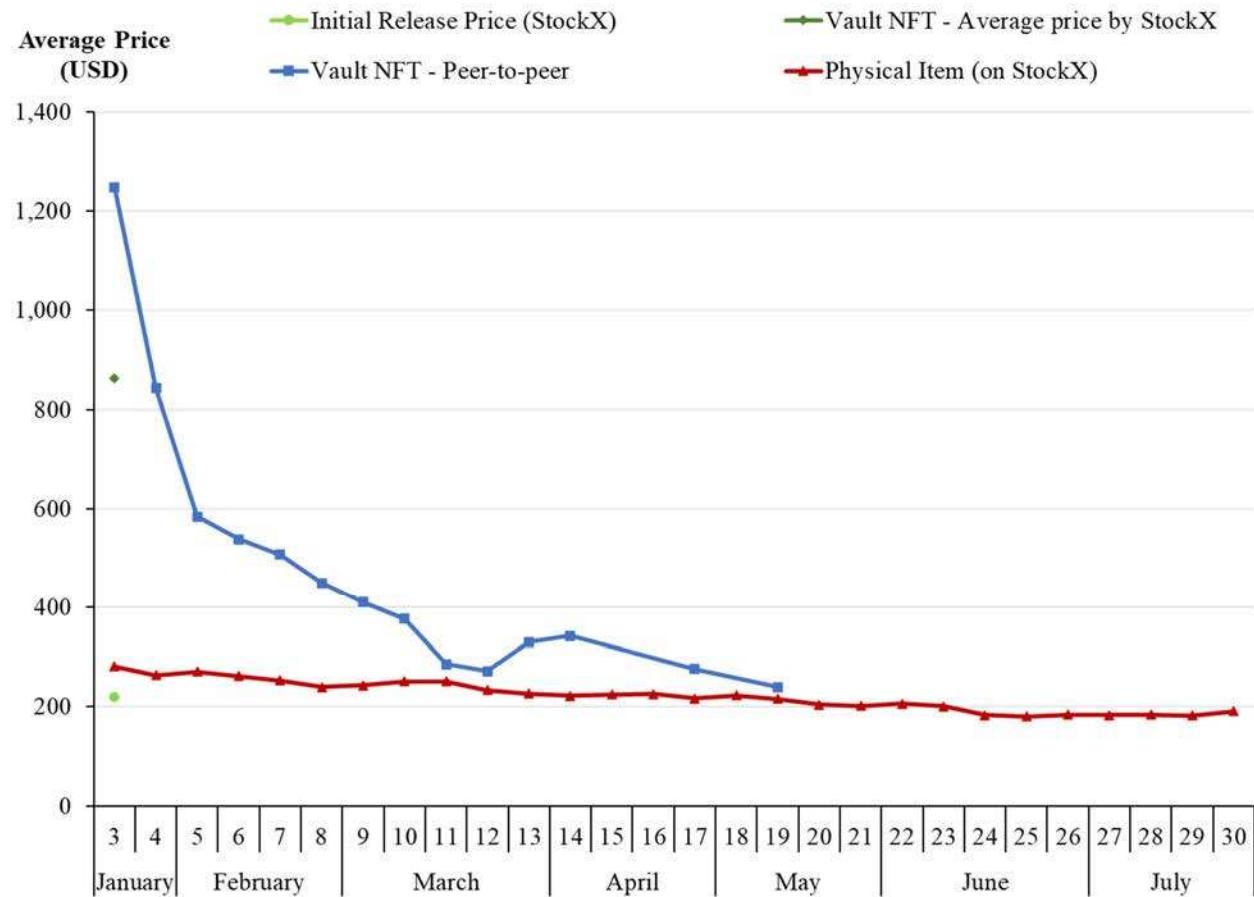
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**Exhibit D2: Weekly Average Prices of Air Jordan 4 Retro White Oreo 2021 Sneakers<sup>213</sup>****Notes:**

- [1] All Vault NFTs for this model were released by StockX on January 18, 2022.
- [2] This chart shows the weekly average price of physical sneaker and Vault NFT transactions, using the variable for Gross Monetary Value. “Vault NFT – Average price by StockX” reflects the average release price of the Vault NFTs that were not sold at the initial release price. “Physical Item (on StockX)” refers to the average price of the associated physical sneaker on StockX. StockX’s initial release price and the average release price differ, as StockX had to release some of their NFTs at market value, rather than their initial price, due to a bug.

<sup>213</sup> StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026. See also StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216 (providing release prices).

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**Exhibit D3: Weekly Average Prices of Nike Dunk Low Retro White Black 2021 Sneakers<sup>214</sup>**

<sup>214</sup> StockX, “Vault NFT Data,” STX0806025; StockX, “Physical Data,” STX0806026. See also StockX, “Vault Drop 1 Pricing,” January 11, 2022, STX0121216 (providing release prices).